This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

+ *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.

+ *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.

+ *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.

+ *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at http://books.google.com/

Digitized by Google

Library
of the
University of Wisconsin

Digitized by Google

Digitized by Google

Digitized by Google

Digitized by Google

Digitized by Google

THE AMERICANA

A Universal Reference Library

COMPRISING THE ARTS AND SCIENCES,
LITERATURE, HISTORY, BIOGRAPHY,
GEOGRAPHY, COMMERCE, ETC.,
OF THE WORLD

EDITOR-IN-CHIEF

FREDERICK CONVERSE BEACH

MANAGING EDITOR

GEORGE EDWIN RINES

ASSISTED BY MORE THAN TWO THOUSAND OF THE MOST EMINENT SCHOLARS
AND AUTHORITIES IN AMERICA AND EUROPE

ILLUSTRATED

SCIENTIFIC AMERICAN COMPILING DEPARTMENT
225 FIFTH AVENUE, NEW YORK

Digitized by Google

Copyright 1912
by
FREDERICK CONVERSE BEACH

Digitized by Google

178015
OCT -9 1913
AE
+AM34
14

THE AMERICANA

DEPARTMENT AND ADVISORY EDITORS

ASTRONOMY
SIMON NEWCOMB, Ph.D., LL.D., D.Sc.

PHILOSOPHY
JAMES E. CREIGHTON, A.M., Ph.D.
Professor of Philosophy, Cornell University

PHYSICS
ROBERT S. WOODWARD, Ph.D., LL.D.
President of Carnegie Institution

PURE MATHEMATICS
CASSIUS J. KEYSER, M.A., Ph.D.
Adrain Professor of Mathematics, Columbia University

EDUCATION
ANDREW SLOAN DRAPER, LL.D.
Commissioner of Education, State of New York

ZOOLOGY
DAVID STARR JORDAN, Ph.D., LL.D.
President of Leland Stanford Jr. University

ENGLISH LITERATURE
WILLIAM P. TRENT, A.M., LL.D.
Professor of English Literature, Columbia University
WILLIAM T. BREWSTER, A.M.
Professor of English, Columbia University

AMERICAN LITERATURE
EDWARD EVERETT HALE, S.T.D., LL.D.
Author of "The Man Without a Country"

CLASSICAL LITERATURE
JAMES H. KIRKLAND, Ph.D., LL.D.
Chancellor of Vanderbilt University

ARCHITECTURE AND THE FINE ARTS
RUSSELL STURGIS, F.A.I.A.
Author of "Dictionary of Architecture"

RELIGION AND THEOLOGY
SYLVESTER BURNHAM, D.D.
Dean of Hamilton Theological Seminary, Colgate University
REV. P. A. HALPIN
Saint Angela's College, New Rochelle, N. Y.

MEDICINE
SMITH ELY JELLIFFE, M.D., Ph.D.
Editor "Medical News."

CHEMISTRY
ALLAN DOUGLAS RISTEEN, Ph.D.
Hartford, Conn.

MINERALOGY
GEORGE LETCHWORTH ENGLISH
New York

LAW
HENRY M. EARLE
New York

ELECTRICITY
WILLIAM MAVER, Jr., C.E.
Consulting Electrical Engineer, New York

ENGINEERING AND MACHINERY
WILLIAM MOREY, Jr., C.E.
Consulting Civil and Mechanical Engineer New York

STEEL
ALBERT SAUVEUR, S.B.
Professor of Metallurgy, Harvard University

JUDAISM
ABRAM S. ISAACS, A.M., Ph.D.
Professor of Semitic Languages, New York University

HISTORY OF THE NATIONS

UNITED STATES
ANDREW C. McLAUGHLIN, A.M.
Editor of "American Historical Review"

CANADA
GEORGE McKINNON WRONG, A.M.
Professor of History, University of Toronto
CHARLES WILLIAM COLBY, A.M., Ph.D.
Professor of History, McGill University

MEXICO
ELISHA HOLLINGSWORTH TALBOT
Author "Commercial and Industrial Mexico"

GREAT BRITAIN
HALFORD JOHN MACKINDER, M.A.
Director of the School of Economics and Political Science in the University of London

GERMANY
HUGO MÜNSTERBURG, Ph.D., LL.D.
Professor of Psychology, Harvard University

FRANCE
HON. HILAIRE BELLOC
M.P. for Salford (Eng.); Author of "Danton," "Robespierre," "Paris," etc.

ITALY
J. S. KENNARD, Litt.D., D.C.L., L.H.D.
Author of "Italian Romance Writers," "Studi-Danteschi," "Romanzi e Romanzieri Italiani," "Les Femme dans le Roman Italien," "The Fallen God," etc.

JAPAN
GEORGE TRUMBULL LADD, D.D., LL.D.
Emeritus Professor of Philosophy, Yale University; Lecturer on Philosophy, Western Reserve University; Lecturer on Education in the universities of Japan.

AUSTRALIA
HON. JOHN GREELEY JENKINS
Premier of South Australia 1901-5; Agent-General in London for South Australia.

Digitized by Google

KEY TO PRONUNCIATION.

ä	far, father
ā	fate, hate
a or ă	at, fat
ã	air, care
ạ	ado, sofa
â	all, fall
ch	choose, church
ē	eel, we
e or ĕ	bed, end
ė	her, over: also Fr. ***e***, as in ***de; eu***, as in ***neuf;*** and ***oeu***, as in ***boeuf, coeur;*** Ger. ***ö*** (or ***oe***), as in ***ökonomie***.
ẹ	befall, elope
ē	agent, trident
ff	off, trough
g	gas, get
gw	anguish, guava
h	hat, hot
ḥ or H	Ger. ***ch***, as in ***nicht, wacht***
hw	what
ī	tile, ice
i or ĭ	him, it
ɪ	between e and i, mostly in Oriental final syllables, as, Ferid-ud-din
j	gem, genius
kw	quaint, quite
ṅ	Fr. nasal ***m*** or ***n***, as in ***embonpoint, Jean, temps***

ñ	Span. ***ñ***, as in ***cañon*** (căn'yŏn), ***piñon*** (pēn'yŏn)
ng	mingle, singing
nk	bank, ink
ō	no, open
o or ŏ	not, on
ô	corn, nor
ȯ	atom, symbol
ọ	book, look
oi	oil, soil; also Ger. ***eu***, as in ***beutel***
ö or oo	fool, rule
ou or ow	allow, bowsprit
s	satisfy, sauce
sh	show, sure
th	thick, thin
ŧh	father, thither
ū	mute, use
u or ŭ	but, us
u̇	pull, put
ü	between u and e, as in Fr. ***sur***, Ger. ***Müller***
v	of, very
y	(consonantal) yes, young
z	pleasant, rose
zh	azure, pleasure

′ (prime), ″ (secondary) accents, to indicate syllabic stress

Digitized by Google

THE AMERICANA

Seward, sū'ard, **Anna**, English poet: b. Eyam, Derbyshire, 1747; d. Lichfield, 25 March 1809. Some of her earlier poetical efforts were an 'Elegy on the Death of Mr. Garrick' and an 'Ode on Ignorance'. Her literary aspirations were fostered by her fellow-townsman, Dr. Erasmus Darwin, of whom she later wrote a 'Memoir' (1804). Her greater success was achieved with a 'Monody on the Death of the Unfortunate Major André' (1781), and an elegiac poem on 'Captain Cook' (1807). Horace Walpole declared she had "no imagination, no novelty," and Miss Mitford spoke of her as "all tinkling and tinsel — a sort of Dr. Darwin in petticoats." Her poems were published in 1810 with a memoir by Sir Walter Scott.

Seward, Frederick William, American lawyer, son of W. H. Seward (q.v.): b. Auburn, N. Y., 8 July 1830. He was graduated from Union College in 1849, admitted to the bar in 1851, and for 10 years was one of the editors and owners of the Albany *Evening Journal*. In 1861 he was sent to apprize Lincoln of the plot to assassinate him in Baltimore, served as assistant secretary of state in 1861–9 and in 1877–81, and narrowly escaped death in defending his father from the assault of 14 April 1865. He went with Admiral Porter on the special mission to negotiate the treaties with the West Indies in 1867, assisted in the purchase of Alaska, and in the negotiations for Pago-Pago Harbor, Samoa. He was a member of the New York legislature in 1875, State commissioner at the Yorktown Centennial Celebration in 1881, and in 1900 became president of the Sagaponack Realty Company. He has published: 'Life and Letters of William H. Seward' (1891); 'A West Indian Cruise' (1894).

Seward, George Frederick, American diplomat, nephew of W. H. Seward (q.v.): b. Florida, N. Y., 8 Nov. 1840. He was educated at Union College, and in 1861 was appointed United States consul to Shanghai, China, where he remained until 1876, serving as consul-general from 1863. In 1876–80 he was minister to China, but was recalled in the last named year in consequence of refusing to undertake the negotiation of a treaty to restrict Chinese immigration. During his residence in China he was active in suppressing riots and in reducing piracy. He has been vice-president of the North China branch of the Royal Asiatic Society since 1887, and since 1893 has been president of the New York Fidelity and Casualty Company. He has published: 'Chinese Immigration in Its Social and Economic Aspects' (1881); 'Digest of System of Taxation of New York' (1902); etc.

Seward, William Henry, American statesman: b. Florida, Orange County, N. Y., 16 May 1801; d. Auburn, Cayuga County, N. Y., 10 Oct. 1872. He was graduated from Union College (1820), and having studied for the law, began practising at Auburn in 1823, but soon indicated a decided bent for politics, which gradually drew him away from the legal profession. In 1830 he was elected as an anti-Masonic candidate to a seat in the New York senate, and from that date he was, with few intervals, in one form or another, an effective and prominent leader in the councils that framed the policy both in his own State and of the Nation. In 1838 he was elected first Whig governor of New York by a majority of 10,421. Though his administration was rendered peculiarly difficult by the internal dissensions of his party, it was marked by wise measures of reform, which definitely added to Whig strength in the State. During his term many of the disabilities of foreigners were removed, the anti-rent troubles were adjusted, the natural history and geological survey of the State was commenced, the State museum of natural history was established, and a bill was passed securing for fugitive slaves a trial by jury with counsel furnished by the State. He was re-elected in 1840. From 1843 to 1849 he was occupied largely with professional practice, though he delivered several addresses on political and other topics, among them one on the life and character of O'Connell, which is accounted one of his happiest oratorical efforts. He was elected in 1849 to the Senate, and there attained great influence as both a party leader and an adviser of President Taylor. In a speech of 11 March 1850 in favor of the admission of California, he spoke of the exclusion of slavery from all new States as demanded by "the higher law," a phrase which greatly offended Southern Democrats, and was made one of the battle-cries of Abolition. Upon Fillmore's accession, Seward strongly opposed that President's pro-slavery attitude, though this was accepted by many Whigs in Congress. Having been re-elected senator in 1855, he took a leading part in the discussions immediately antecedent to the Rebellion. In an address at Rochester, N. Y., in October 1858, he made reference to the "irrepressible conflict" whose outcome must make the United States a nation either all of free labor or all of slave. In 1856 and again in 1860 he was the most prominent Republican candidate for the Presidential nomination, receiving on the first ballot at the Chicago convention in 1860 173½ votes as against 102 for Lincoln, who was eventually chosen. Seward, however, spoke for Lincoln in West and East, and was made secretary of state. This post he filled with notable efficiency, particularly in connection with the foreign relations of the government. He reorganized the diplomatic service, and by his able despatches and the instructions furnished to representatives abroad retained the confidence of Europe, which had been ready to grant recognition and support to the Confederacy. A famous incident of his secretaryship was the correspondence with Great Britain àpropos of the "Trent affair." When the Confederate agents, Slidell and Mason, were removed from the British ship Trent, their restoration was peremptorily called for, and war seemed certain. The answer, formulated by Seward and

Digitized by Google

slightly amended by Lincoln, by its skill, closed the matter. Great Britain, it said, now recognized the principle of exemption from search, contended for in the War of 1812 by the United States, which now therefore willingly released the prisoners. Seward insisted on redress for American citizens for depredations by the Alabama (see ALABAMA CLAIMS). At the time of the assassination of Lincoln, an unsuccessful attempt was made on the life of Seward, then ill at Washington. Seward was retained by Johnson, but retired in March 1869. He published a 'Life' of J. Q. Adams (1849). An edition of his 'Works' appeared in 1853, including speeches, addresses, and essays. Consult the autobiography and memoir published in 1877; Lothrop, 'William Henry Seward' (1896).

Seward, Neb., city, county-seat of Seward County; on the Big Blue River, and on the Chicago, B. & Q. and the Fremont, E. & M. V. R.R.'s; about 26 miles west by north of Lincoln, the capital of the State. It is in an agricultural and stock-raising region, in which wheat and corn are the chief farm products. The city has flour mills, grain elevators, stock yards, and creameries. There is a large trade in grain and live stock. The four banks have a combined capital of $210,000. Pop. (1890) 2,108; (1900) 1,970; (1910) 2,106.

Seward Peninsula. See ALASKA.

Sewell, sū'ĕl, **Elizabeth Inissing,** English novelist: b. Newport, Isle of Wight, 19 Feb. 1815. She wrote extensively, her works covering travels, religious topics, poetry, and various histories for young people, beside the novels upon which her reputation rests. They are of the High-Church school of fiction, were once widely popular in England and the United States, and include: 'Amy Herbert' (1844); 'Lauton Parsonage' (1846); 'Margaret Percival' (1847); 'Ursula' (1858); etc.

Sewell, William Joyce, American statesman: b. Castlebar, Ireland, 6 Dec. 1835; d. Camden, N. J., 27 Dec. 1901. He came to the United States in 1846, served as a sailor for a time, and later engaged in business. He served in many battles of the Civil War, and at its close was brevetted brigadier-general and major-general. He was interested in railroad affairs after the war; was elected to the New Jersey senate in 1872, and was president of that body in 1876, 1879, and 1880. He was United States Senator from New Jersey in 1881–7 and 1895–1901. In 1899 he became major-general of the New Jersey National Guard.

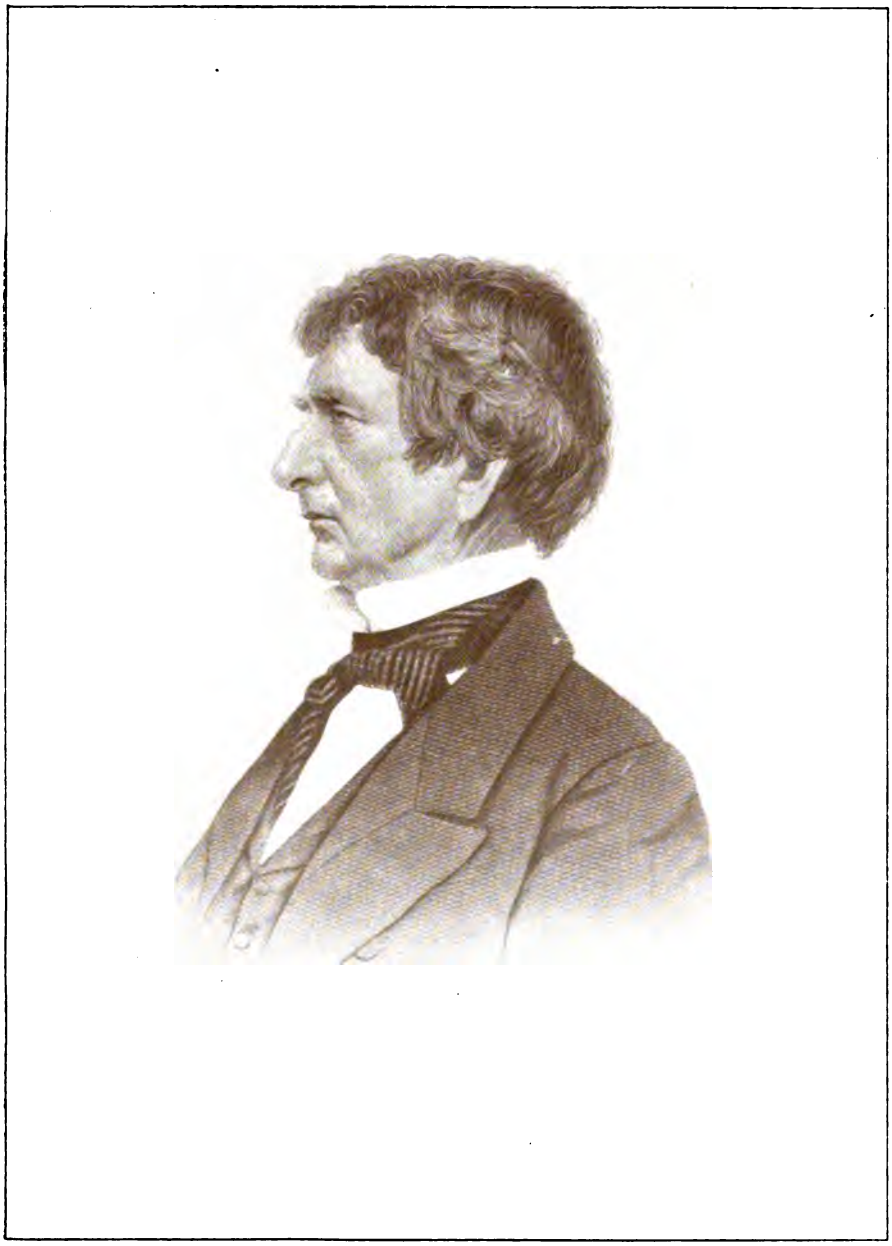
Sewellel, a terrestrial rodent (*Haplodon rufus*) which is formed into a family by itself, and regarded as a connecting link between beavers and squirrels. It is represented by a single species (*H. rufus*), restricted to "a small area on the west coast of North America, in Washington, Oregon, and California." The aborigines called it "Showt'l" or "Sewellel," the trappers the "Boomer" or "Mountain Beaver." The animal is plump, with broad head, short limbs, and hardly any tail; measures about a foot in length; and has a brownish color. It lives socially in colonies, burrows underground, and lives on vegetable matter. As a connecting link *Haplodon* is of much interest to naturalists, while the Indians use its skin and probably also its flesh.

Sewerage. See SANITARY ENGINEERING.

Sewing Machines. On 17 July 1790 Thomas Saint, an Englishman, secured a patent on a machine to be used for "quilting, stitching, and sewing, making shoes and other articles." The patent was for some sort of a machine connected with boot-making, and the specifications and drawings of the patent comprised, among other things, a crude stitching device for forming a chain-stitch. This patent was discovered a few years ago by a searcher among the ancient archives of the British Patent Office, where it had lain unnoticed for well-nigh a century, no attempt, so far as is known, having ever been made to introduce into practical use the mechanisms described in the patent. Between 1790 and 1841 several parties obtained patents for stitching devices, making the tambour and chain-stitches, none of which was commercially successful, one of the fatal defects in each being the fact that the cloth had to be fed by hand. When, in 1841, Newton and Archbold patented in England a needle with an eye near the point, and which is essentially the same needle now in use by all sewing-machine manufacturers, one of the greatest difficulties that had theretofore stood in the way of making the sewing machine a practical success was overcome. In 1818 a sewing machine which made a back-stitch was invented by the Rev. John Adams Dodge, of Monkton, Vt., but was neither patented nor manufactured for sale. The first sewing machine put into operation was patented in France, in 1830, by Barthlémy Thimonnier, and was used principally in the manufacture of clothing for the French army, but it was later destroyed by a mob. In 1848 he put another machine on the market and on 3 Sept. 1850 took out a patent in the United States.

A machine having a needle with an eye near the point attached to the end of the vibrating arm was invented and manufactured in 1832–4, in New York, by a machinist named Walter Hunt. This machine was a lock-stitch and used two continuous threads. In 1842 a machine for sewing leather and various other heavy materials was invented by J. J. Greenough, but this did not become generally used. In 1843 a machine somewhat similar to the Greenough machine was invented by George H. Corliss. This had an automatic feed, and the needles, of which there were two, were run horizontally through the goods to be sewed. Numerous other inventions were made between the years 1849 to 1851, the most important of these being the machine for the manufacture of clothing made by Lerow and Blodgett. This had a curved shuttle, adjustable feed, and automatic tension, and the baster-plate consisted of a circular hoop studded with pins. The next invention patented that covers a fundamental and important feature was that of John Bachelder, patented 8 May 1849. Bachelder's machine was the first to embody the horizontal table with a continuous feeding device that would sew any length of seam. His invention consisted of an endless leather belt set with small steel points projecting up through the horizontal table and penetrating the material

Digitized by Google



HON. WILLIAM S. SEWARD.

Digitized by Google

Digitized by Google

to be sewed, carrying it along intermittently at a proper time to meet the action of the needle.

Elias Howe, Jr., began his experiments in 1843, and secured his first patents 10 Sept. 1846. Howe's principal improvements were the shuttle, producing the lock-stitch, and the feed motion. Later, Howe made other improvements, but the machine bearing his name was not patented until 1857. Howe's invention consisted of the combination of the eye-pointed needle with a shuttle for forming a stitch, and an intermittent feed for holding and carrying the material forward as each stitch is formed. The mechanical device for the feed was called the «baster-plate,» and the length of the seam sewed at one operation was determined by the length of this plate. The material to be sewed was hung by pins to the «baster-plate» in an upright position, and if the seam to be sewed was of greater length than the plate it was necessary to rehang it on the plate, which was moved back to position in the same manner as a log is carried back and forth in a saw-mill.

In 1847, Allen B. Wilson, then working as a journeyman cabinet-maker in Adrian, Mich., conceived the idea of a sewing machine, although he had never heard of one. He did not complete full drawings of his machine until the latter part of 1848. Early in 1849, he determined to build a model, and began, on 3 Feb. 1849, the construction of his first machine, which he completed in about 60 days. Having been compelled, by lack of means, to construct every part of the machine himself, the iron and steel as well as the wood, although he was not a practical machinist and lacked suitable tools for the metal work, the machine was consequently of imperfect construction, and could not illustrate in the best manner the principles of his invention. It worked, however, and with it were made dress waists and other articles that severely tested its capacity. This machine made the lock-stitch, the lower thread being carried by a double-ended shuttle. The machine contained the first automatic feed movement ever produced, and was the first that could sew curved seams or turn a sharp angle. Without such a device, the machine would have been a practical failure, as Howe's really was, and as were all others until Mr. Wilson's inventions. His first device was what is known as the «two-motion feed,» to distinguish it from his «four-motion feed,» a still more effective device afterward invented by him. The «two-motion feed» consisted of a horizontally reciprocating tooth surface (the pitch of the teeth being forward) engaging the material at all times, and while the needle was in the material moving back to take a new stroke. A patent on this machine was granted Mr. Wilson on 12 Nov. 1850. Wilson had, while in New York, constructed a model of a machine containing a rotary hook and reciprocating bobbin, gave all his energies to perfecting the new machine, and obtained a patent for it 12 Aug. 1851.

It is a remarkable coincidence that on the same day a patent was granted to Isaac M. Singer for his first machine. The main features of the Singer machine were its straight needle, working at the extremity of a stationary overhanging arm, and its feed, consisting of a roughened wheel. A straight shaft in the overhanging arm imparted the motion to the needle, and the shuttle was driven in its race below the feed table by a mechanism deriving its motion from the shaft by means of gearing. The feed consisted of an iron wheel with a corrugated surface, the top of which was slightly elevated above the level surface of the table. By an intermittent motion the feed carried the cloth forward between stitches without injury to the fabric. This device permitted the cloth to be turned in any direction by the operator while sewing, which was impossible with the styles of feed which perforated the goods. The material was held in place by a presser foot alongside the needle. This presser foot embraced an important feature possessed by no other sewing machine up to that time — the yielding spring, which would permit of passage over seams, and adjust itself automatically to any thickness of cloth. It was claimed that this was an improvement over Mr. Wilson's first feed, in that there was no backward motion while in contact with the cloth. It had, however, the disadvantage of touching the cloth only on a small portion of its periphery — theoretically at only a point, and practically only a little more. It was claimed by Messrs. Wheeler & Wilson to be really an infringement of Wilson's patent, the principle of which was the holding of the cloth between a roughened or toothed surface on the under side and a smooth surface touching it with an intermittent motion, permitting the turning of the cloth in either direction while the machine was in motion; and this claim was sustained by the court.

On 19 Dec. 1854, a patent was issued for Mr. Wilson's celebrated «four-motion feed,» so called from the peculiarity of the device by which the flat-toothed surface of the feed, being in contact with the cloth, is moved forward, carrying the cloth with it; then drops out of contact with the cloth, is moved backward and then rises up against the cloth and is again ready for the first motion. This device solved the problem of a thoroughly practical and effective feed, and was soon generally adopted and has become the feed motion of the world. This feed-motion, although it was not patented until this late date, had been long previously invented by Mr. Wilson, and was described in his application for a patent in 1851, but the claim was not pursued for the reason that he believed at the time that he had been anticipated by W. O. Grover, of the firm of Grover & Baker. It was ascertained afterward, however, that Mr. Wilson was really prior in the invention, and, without contest on the part of Mr. Grover, the patent was granted to Mr. Wilson. This machine was invented by Grover & Baker on 11 Feb. 1851, and had a double-loop stitch made by a combination of a circular reciprocating under needle and a curved upper needle with an eye near the point. This eliminated both shuttle and bobbin and rendered it possible for the upper and under threads to be taken from commercial spools. These machines, though once popular, are not now manufactured.

In 1855 litigation arose involving the three principal sewing-machine companies then in existence, each claiming that the others were infringing upon certain of their patent rights, and numerous suits were instituted, more par-

Digitized by Google

ticularly by Howe, whose patents were so skillfully drawn that he claimed all others were infringements.

In 1856 the three principal sewing-machine companies — Wheeler & Wilson, Singer and the Grover & Baker — formed a combination. It was contracted by the three companies and Mr. Howe that they would stop their litigation, and, with a fair payment to each other and to Mr. Howe for special rights, would carry on the business with only honorable competition. They finally agreed to license any responsible person who should propose to engage in the manufacture of a good machine on the payment of a royalty, which for several years was $3 on a machine.

The next machine to be put on the market was the Willcox & Gibbs. This machine, which had a rotating hook for using a single thread to make the twisted loop-stitch, was first patented in June 1857, by James E. H. Gibbs, of Millpoint, Va. Later James Willcox, of Philadelphia, added some further improvements, and the machine then became known as the Willcox & Gibbs. Several years afterward an automatic tension was placed on this machine by Charles H. Willcox.

While the manufacture of machines for the home has been developing and progressing, those for manufacturing purposes have in no less a degree been brought to a state bordering on perfection. There are now machines for making — or which have special attachments for making — every conceivable article of clothing, upholstery, embroidery, leather goods, etc. We have the button-hole, the button-sewer, the French-knot, the faggoting, feather-stitching, hemstitch, side and box-plaiters, corset machines; the cylinder for seam work on sleeves, trousers, bootlegs, leather buckets, etc.; machines for embroidery, smocking, carpet, awnings, etc.; the single and double-needle machines and those with four, six, and eight needles for glove work, special machines for overalls, sail-making, flag-making, and a host of others too numerous to mention. Many of the machines may be used for several different purposes by simply changing the style of feed motion, presser foot, needle, etc., while the other parts of the mechanism remain substantially the same. There have been several thousand patents granted on sewing machine appliances.

The production of sewing machines has become a wonderful industry in the United States, which leads the world in their manufacture. In 1900 there were 58 concerns engaged in the industry, capitalized at $18,739,459; employing 624 salaried clerks and officials, with salaries aggregating $842,468, and 10,635 wage-earners, with wages of $6,213,938; their miscellaneous expenses were $864,451; cost of material used, $7,809,796; and the value of their production was $18,314,419. Besides these there were 7 establishments making sewing-machine cases, producing goods annually to the value of $2,815,142. The product in 1900 included 747,587 machines for domestic use and 55,227 machines for manufacturing purposes. In the same year the exports amounted to $4,541,774.

Sexagesima (sĕks-a-jĕs'ĭ-ma) **Sunday,** the second Sunday before Lent. See QUINQUAGESIMA.

Sextant, a portable instrument for measuring the altitudes of the heavenly bodies above the horizon, or their angular distance as seen in the sky. It was invented independently by Thomas Godfrey, of Philadelphia, and Captain Hadley of the British Navy, about 1730. The principles on which it works will be seen by a study of Fig. 1. C is a plain flat mirror, of

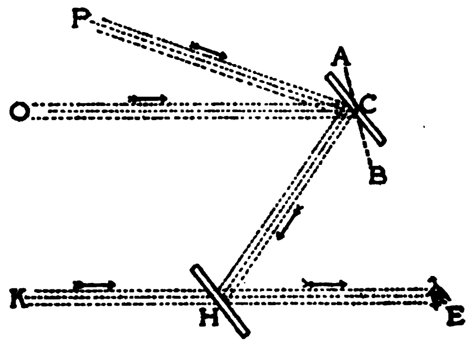


FIG. 1.

which the polished side is turned downward and toward the left. H is a flat plate of polished glass through which an eye placed at E may view a distant object in the direction K by light coming through it in the direction of the dotted lines. Light emanating from another object O or P and falling on the mirror C will, where the mirror is properly directed, be reflected along the line CH and, in striking the glass plate H, a certain portion of it will be reflected in the direction HE, so that the observer with his eye at E will see both the objects K and O or P in coincidence. If the mirror C is set parallel to H as in the figure, the rays KE and OC will be parallel, and may therefore be considered as emanating from the same object at an infinite distance.

Thus the eye will see two images in the mirror as if together. But if the mirror C be moved into a different direction, that shown by the dotted line AB for example, the direction of the ray, the direction of the line PC, the rays along which are reflected to H, will deviate from OC by double the angle through which the mirror has turned. This doubling is caused by the fact that the angles of incidence and reflection are both changed by the motion of C. It follows that if the observer can measure the angle between the mirror C and H, doubling this angle will give him the difference of direction between the rays coming from K and from P.

The sextant is used to measure this angle. The essential parts of it are shown in Fig. 2. The part ABC consists of the arc AB round C as a centre and firmly fastened by the radii CB and CA which are again firmly connected by a framework not shown in the figure. To this framework is attached the fixed plate of glass H, of which the lower half is silver while the upper half is transparent. T is a telescope, also firmly fixed to the frame, through which the eye looking in at E may see a distant object through the transparent portion of the mirror, and at the same time see any other object by the light reflected from the silvered part.

Digitized by Google

The arc AB is graduated to degrees and fractions as shown by the figures. Owing to the doubling of the angle, the measures on the arc BA are also double. That is to say,

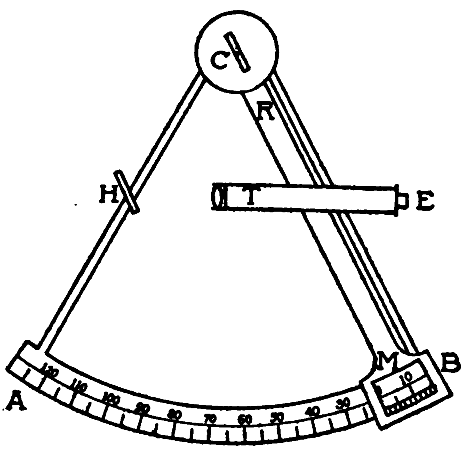


FIG. 2.

this arc is only 60 degrees in length, but is divided into 120 degrees, so as to show the actual altitude of the object observed.

RM is a movable arm carrying a mirror C called the index glass, fixed to it perpendicularly at its upper end. The arm revolves around C as a centre. At its lower end there is an index mark and vernier by which the position of the arm with respect to the graduations on the arc may be determined.

The altitude of a heavenly body at C is then measured by the observer taking the instrument in his hand and holding it in a vertical position, with the telescope ET horizontal, so that the sea horizon may be seen through the transparent part of the horizon glass H. The observer facing in the vertical plane of the sun or other object then turns the arm RM around the centre C until he brings the sun into sight, through its rays being reflected first from C and then from H. When the limb of the sun is thus made to coincide with the horizon, the angle through which the arm RM has moved from parallelism is shown by the position of the index on the graduated arc BA, which is then determined by the vernier.

In ordinary use the navigator never has to measure angles exceeding 90 degrees. In this case the arc BA need only to be 45 degrees in actual length. The instrument is then called a quadrant. This was the original form used by Hadley.

For very accurate use the arc is extended down so as to form a complete circle. A special device is employed to bring about the proper reflection of the light; but the reflecting circle, as the instrument is called, is too complicated to admit of common use by the navigator.

S. NEWCOMB.

Sextet (from Lat. *sextus*, sixth). In music, a composition for six voices or instruments, or for voices with instrumental accompaniment. Instrumental sextets are generally compositions in sonata form.

Sexton, a church officer whose duties consist in taking care of the church generally, to which used to be added the duty of digging and filling up graves in the churchyard, when the church had a cemetery attached to it. In the United States the sexton is also very often an undertaker, and thus continues in a form different from the old-time sexton, to attend to the interment of church members.

Sex'tus (surnamed EMPIRICUS, from his belonging to the empiric school of medicine) was a skeptic who flourished in the first half of the 3d century. He was a Greek by birth, and lived at Alexandria and Rome. Skepticism appears in his writings in the most perfect state which it reached in ancient times. (See SCEPTICISM.) We have two works by him, written in the Greek language, and they are the source of our knowledge of the Greek skeptical philosophy. One of them entitled 'Outlines of Pyrrhonism,' in three books, explains the method of Pyrrho; the other, entitled 'Against the Mathematicians,' is an attempt to apply that method to all the prevailing philosophical systems and other branches of knowledge.

Sexual Selection, a term invented by Darwin to denote a special phase of natural selection, depending on a competition between rival males, in which a premium is set on those qualities which favor their possessors in securing mates. This competition takes two forms: On the one hand, rival mates, for instance stags or gamecocks, fight with one another, and the conquerors have naturally the preference in mating; on the other hand, rival males sometimes seem to vie with one another in displaying their attractive qualities before their desired mates, who, according to Darwin, choose those that please them best. Darwin gives the following summary of his theory:

> It has been shown that the largest number of vigorous offspring will be reared from the pairing of the strongest and best-formed males, victorious in contests over other males, with the most vigorous and best-nourished females, which are the first to breed in the spring. If such females select the more attractive and, at the same time, vigorous males, they will rear a larger number of offspring than the retarded females, which must pair with the less vigorous and less attractive males. So it will be if the more vigorous males select the more attractive and, at the same time, healthy and vigorous females; and this will especially hold good if the male defends the female, and aids in providing food for the young. The advantage thus gained by the more vigorous pairs in rearing a larger number of offspring has apparently sufficed to render sexual selection efficient.

In regard to the second aspect of sexual selection, in which the females are believed to exercise some choice, giving the preference to those suitors which have brighter colors, more graceful forms, sweeter voices, or greater charms of some kind, there is no little difference of opinion. Darwin indeed believed strongly in the female's choice, and referred to this process of selection many of the qualities which distinguish male animals. The females "have by a long selection of the more attractive males added to their beauty or other attractive qualities." On the other hand, Alfred Russel Wallace maintains a very different position. "There is," he says, "a total absence of any evidence that the females admire or even notice the display of the males. Among butterflies there is

Digitized by Google

literally not one particle of evidence that the female is influenced by color or even that she has any power of choice, while there is much direct evidence to the contrary.» Against this, G. W. and E. G. Peckham, in their careful essay on sexual selection in spiders, state that they have in the *Attidæ* «conclusive evidence that the females pay close attention to the love dances of the males, and also that they have not only the power, but the will, to exercise a choice among the suitors for their favor.» Some observers of birds are also confident that the females choose the more musical or otherwise attractive males. But again Wallace maintains that the fact that every male bird finds a mate «would almost or quite neutralize any effect of sexual selection of color or ornament; since the less highly colored birds would be at no disadvantage as regards leaving healthy offspring.»

The theory of sexual selection is of considerable importance in a general theory of evolution. This may be illustrated in reference to the bright plumage of many birds. If we postulate successive crops of variations (which cannot at present be completely rationalized), if we acknowledge that there is really «preferential mating» among birds (which is not readily proved or disproved), if we believe that the females are sensitive to the slight excellences which distinguish one suitor from another and that their choice of mates is determined by these excellences (which Wallace emphatically denies), then we may say that the greater brightness of male birds may have been evolved by sexual selection. This was Darwin's opinion. The brighter males succeeded better than their rivals in the art of courtship; the variations which gave them success were transmitted to the offspring; gradually the qualities were established and enhanced as secondary sexual characters of the species. But Wallace interpreted the facts quite otherwise. The relatively plain plumage of the female birds was due to natural selection, eliminating those whose conspicuousness during incubation was fatal, fostering those whose coloring was protective. Just as Daines Barrington, a naturalist, still remembered as the correspondent of Gilbert White, suggested (1773) that singing birds were small and hen birds mute for safety's sake, so Wallace maintained that female birds had forfeited brightness as a ransom for life.

The doubts and difficulties arouse skepticism as to the thoroughness of the explanations of secondary sexual characters suggested either by Darwin or by Wallace. It is not surprising, therefore, to find Mivart's explanation of the beauty of males as the direct expression of an internal force, or Mantegazza's hints as to physiological explanation of the sexual divergence, or Brook's reference to «something within the animal which determines that the male should lead and the female follow in the evolution of new breeds.» Geddes advanced further, endeavoring to interpret the secondary sexual characters as outcrops of the relative preponderance of anabolism and katabolism characteristic of females and males respectively. Gay coloring — sometimes at least due to pigmented waste products — is regarded as a characteristic expression of the predominantly katabolic or male sex, and quiet plainness is equally natural to the more anabolic females. But this theory, which seeks to rationalize the variations which Darwin simply postulated, is by no means inconsistent with a recognition of sexual selection as an accelerant directive process in the evolution of male brightness, or of natural selection as a retardative directive process eliminating disadvantageously conspicuous females.

Wallace in his later works advanced toward a rational interpretation of the variations which he was previously content to postulate as facts. For he says that «ornament is the natural outcome and direct product of superabundant health and vigor,» and is «due to the general laws of growth and development.» It seems to some that this mode of interpreting characters is of far-reaching importance, and that it affects not only the theory of sexual selection but that of natural selection as well.

To sum up, the problems involved in sexual selection are (1) what physiological conditions explain the secondary sexual characters which so often distinguish males and females; (2) to what extent and in what degree of refinement does preferential mating occur; and (3) to what extent has sexual selection guided the differentiation of the sexes alike in distinctive qualities and in æsthetic sensitiveness? Before these problems can be adequately solved many more facts must be accumulated.

Consult: Darwin, 'Origin of Species,' 'Descent of Man'; Wallace, 'Natural Selection,' 'Darwinism'; L. Morgan, 'Habit and Instinct,' and other books.

Seychelles, sā-shĕl', a group of islands in the Indian Ocean, belonging to England. Their formation is peculiar, as they are the only tropical islands of granite structure. The archipelago comprises 80 islands, rising precipitously from the water to a height of 2,998 feet in the largest of the group, Mahé, which has an area of 55½ square miles. Mahé is central and, with a few of the others, is inhabited. The white sandy beaches are enclosed by coral reefs. The soil is fertile, the climate temperate. There are many brooks and streams. The islands are covered with verdure (enormous ferns, sensitive plants, and palms grow) and valuable woods, adapted to cabinet work or ship-building. Vanilla, coffee, cocoa, spices, tobacco, corn, tropical fruits, and vegetables are grown. The exports are the fibres, nuts, and oil of the cocoanut palm; vanilla, soap, tobacco, tortoise-shell, and vacoa bags. The imports are cotton, coal, wine, coffee, and cotton goods. Coco-de-mer (q.v.) is peculiar to Praslin. Enormous tortoises of the edible sort are common. The adjacent seas contain numerous fish, some of gorgeous colors. The inhabitants contruct their homes of a species of coral which glistens like marble and is hewn into massive blocks. The chief harbor is Port Victoria, on Mahé Island. There is much land suitable to, but not as yet under, cultivation. The Seychelles were discovered by the Portuguese, and first colonized by the French (1743), of whom the present inhabitants are descendants. The British captured the islands in 1794, and at the Peace of 1814 they were ceded to them. Pop. about 22,000.

Seychelles Cocoanut, a palm (*Lodoicea sechellarum*), peculiar to the Seychelles Islands, sometimes 100 feet high, crowned by immense palmate leaves, which make good material for

Digitized by Google

hat plaiting and basketry, and when mature are used for house partitions and for thatching. The fruits are gigantic in size, sometimes weighing as much as 50 pounds, and were anciently supposed to grow on sub-marine palms, since they were found only when washed ashore on Asiatic coasts. This circumstance caused many superstitions to arise, especially that they were a powerful cure for snake poison, and they therefore commanded high prices in the East, and were called coco-de-mer, sea, double, or Maldive cocoanuts. There are from one to four stony nuts in a husk, each being deeply lobed at each end. This floating apparently double nut may have given rise to the types of twin boats. The unripe fruit is edible and the hard black shell of the nuts is carved into ornaments and fakers' drinking cups. See PALMS.

Seymour, sē'mŏr, a noble English family of Norman origin. Their name is corrupted from Saint Maur, their seat in Normandy. They acquired lands in Monmouthshire in the beginning of the 13th century, and early in the 15th century added to these estates others in Somersetshire. The first member to become conspicuous was Sir John Seymour, the father of the third wife of Henry VIII. and of Edward Seymour, protector of the realm of England during the minority of Elward VI., whose uncle he was. He commanded in a maritime expedition against the Scots in 1544, when he landed a body of troops at Leith, and set fire to the city of Edinburgh. By the will of Henry he was nominated one of the council of regency during the minority of Edward VI.; but, not content with his share of power, he procured himself to be appointed governor of the king and protector of the kingdom (January 1547). In the month following he obtained the post of lord-treasurer, was created first Duke of Somerset, and made earl-marshal. The same year he headed an army, with which he invaded Scotland, and after having gained the victory of Musselburgh returned in triumph to England. His success excited the jealousy of the Earl of Warwick and others, who procured his confinement in the Tower. Six months after he obtained a full pardon from the king, and was ostensibly reconciled to his adversary, Lord Warwick. The reconciliation was probably insincere, as Warwick caused Somerset to be again arrested, in October 1551, on the charge of treasonable designs. He was tried, found guilty, attainted, and beheaded on Tower Hill in January 1552. His eldest son by his second wife was created by Elizabeth Earl of Hertford. The Earl of Hertford under Charles II. having distinguished himself in support of the royal cause during the parliamentary war, obtained in his favor the revival of the title of Duke of Somerset, and took his seat in the House of Lords as second duke in 1660. On the extinction of his line the descendants of the first Duke of Somerset by his first wife claimed the title, and on the advice of the attorney-general that claim was pronounced good by the House of Lords, in which body the descendants of that claimant still hold a place.

Seymour, George Franklin, American Protestant Episcopal bishop: b. New York 5 Jan. 1829; d. Springfield, Ill., 8 Dec. 1906. He was graduated from Columbia in 1850, from the General Theological Seminary in 1854, and ordained in the priesthood in 1855. He held various charges in New York State, founded Saint Stephen's College at Annandale, N. Y., in 1855, and was its warden until 1861. In 1865–79 he was professor of ecclesiastical history at the General Theological Seminary, of which he was also dean in 1875–9, and in 1878 he was consecrated first bishop of Springfield. He published: 'What is Modern Romanism' (1885); 'Marriage and Divorce' (1893): 'The Church Idea of the Family' (1899); 'Sacraments and Principles of the Church' (1 vol. 1903); etc.

Seymour, Horatio, American statesman: b. Pompey Hill, Onondaga County, N. Y., 31 May 1810; d. Utica, N. Y., 12 Feb. 1886. He was educated at Geneva Academy (now Hobart College) and at a military school at Middletown, Conn.; studied law at Utica and was admitted to the bar in 1832. In 1833 he became military secretary to Governor Marcy and held the position six years. He was elected to the State assembly by the Democrats of Oneida County in 1841; was mayor of Utica in 1842; re-entered the assembly in 1843 where, as chairman of the committee on canals, he outlined the policy subsequently followed by the State. He was chosen speaker in 1845, and nominated for governor in 1850, was defeated by Washington Hunt, but in 1852 was elected by a large majority. During his term a prohibition law was passed by the legislature and was vetoed by him as unconstitutional. The strong temperance sentiment prevalent at the time made his act very unpopular. During the term of his successor the vetoed law was again passed by the legislature, but was declared unconstitutional by the Court of Appeals. He was again elected governor in 1862 and made an unequivocal declaration in favor of the supremacy of the Constitution and the restoration of the Union, though he denied that the War was the unavoidable result of slavery, or that slavery should be abolished in order to restore the Union. In July 1863 serious riots broke out in New York, involving loss of life and destruction of property. These were caused by the draft-law which discriminated against New York city, in the allotment of quotas. The Governor's complaint to the President secured an investigation which resulted in procuring a correction of the errors of the enrolment. In 1868 he was nominated for the Presidency, but was defeated by Ulysses S. Grant. Consult: Croly, 'Seymour and Blair: their Lives and Services' (1868); Hartley, 'Horatio Seymour' (1886).

Seymour, Lady Jane, queen of England: b. England about 1509; d. Hampton 24 Oct. 1537. She was the third wife of Henry VIII. (q.v.) and the mother of Edward VI. (q.v.). She was the first maid of honor to Anne Boleyn, whom she supplanted in 1536, and favored the Protestant Reformation.

Seymour, Thomas Hart, American legislator and diplomat: b. Hartford, Conn., 1808; d. there 3 Sept. 1868. He was educated at a military academy at Middletown, Conn., became a lawyer at Hartford, and was editor of 'The Jeffersonian Democrat' in 1837. He was a member of Congress in 1843–5, served through the Mexican War, rising to the rank of colonel, and in 1850–3 was governor of Connecticut. He

Digitized by Google

was United States minister to Russia in 1853-7, and during the Civil War acted as leader of the Connecticut Peace Democrats, in which connection he lost much of his popularity.

Seymour, Truman, American soldier: b. Burlington, Vt., 25 Sept. 1824; d. Florence, Italy, 30 Oct. 1891. He was graduated from West Point in 1846, fought in the Mexican War and was brevetted captain. In 1850-3 he was assistant instructor at West Point, served in the Seminole war of 1856-8, and under Major Anderson at the defense of Fort Sumter in 1861, receiving the brevet of major in recognition of his services. He became chief of artillery in McCall's division of the Army of the Potomac in 1862 and was commissioned brigadier-general of volunteers. He was engaged in the Virginia and Maryland campaigns, was in command of a division at Malvern Hill, Manassas, South Mountain, and Antietam, receiving rank of brevet colonel. As chief of staff to the commanding general of the Department of the South in 1863 he led a division on Folly Island, took part in the attack on Morris Island, and commanded the unsuccessful assault of Fort Wagner on 18 July. He commanded a brigade in the battle of the Wilderness, was taken prisoner, and after his exchange in the following August was in command of a division in the Shenandoah Valley, and was engaged in the operations around Petersburg until the close of the War. He was brevetted major-general of volunteers and brigadier-general in the regular army, and in 1865 was mustered out of the volunteer service. He became major of artillery in 1866 and served in command of various forts until his retirement in 1876.

Seymour, Conn., town in New Haven County; near the junction of Bladen, Little, and Naugatuck rivers, and on the New York, New Haven & Hartford railroad; nine miles northwest of New Haven. Seymour is one of the oldest towns of Connecticut. The manufacturing of woolen goods was begun here the last of the 18th century. In 1803 General David Humphreys (who was the first to bring merino sheep into the United States) bought the woolen mill and enlarged it to what was then called a large factory. In 1836 the place was incorporated under the name of Humphreysville, and in 1850 it was incorporated as a town under its present name. The chief manufactures are woolen goods, mechanics' tools, agricultural implements, nails, pins, paper, and rubber. There are five churches, a high school, public graded schools, private schools, and a public library. Pop. (1910) 4,786.

Seymour, Ind., city in Jackson County; on the Pittsburg, C., C. & St. L., the Baltimore & O. S. W., the Southern Indiana, and the Evansville & T. H. R.R.'s; about 55 miles south of Indianapolis and 50 miles north of Louisville, Ky. It is in an agricultural and stock-raising region, and has considerable manufacturing interests. The chief industrial establishments are woolen mills, foundry, rolling and planing mills, cradle factories, harness works, carriage works, and furniture factory. A number of men are employed in the machine shops of the Ohio and Mississippi division of the Baltimore & Ohio Southwestern railroad. There is considerable trade in the manufactures, live-stock, farm, and dairy products. There are 11 churches, the Shields high school, Saint Ambrose Academy, public and parish elementary schools. The two national banks have a combined capital of $200,000. Pop. (1910) 6,305.

Sfax, sfäks, Tunis, a town on the east coast, on the Gulf of Cabes, opposite Kerkenna Island. It is strongly fortified and surrounded by gardens and villas. The European, Arab, and French portions are the three distinct divisions of the town. The first modern, the second — in the central portion — walled and entered by two gates; the third, a camp. Sfax is an important seaport, with a considerable trade in dates, olive-oil, wool, fruits, sponges, grasses, etc.; cotton, woolen, and silk goods are manufactured. A safe harbor and a railway connecting with the interior are modern features. Sfax was occupied in the 12th century by the Sicilians, and in the 16th century for a brief period, by the Spaniards. One of the principal events of the conquest of Tunis by the French was the bombardment of the town in 1881. Pop. 15,000.

Sforza, sfŏrt'sä, a celebrated Italian house, which played an important part in the 15th and 16th centuries, gave six sovereigns to Milan, and formed alliances with most of the princely houses of Europe. The founder of the house was a peasant of Cotignola in Romagna, GIACOMUZZO (Giacomo or Jacopo Muzio) ATTENDOLO: b. Cotignola, in the Romagna, 10 June 1369; d. 4 Jan. 1424, whose skill and courage made him one of the most powerful condottieri of Italy. His surname of Sforza (the forcer), which vouches for his great strength, he is said to have received from Alberigo Barbiano, the true founder of the condottiere mode of warfare in Italy. He served in the wars in the Papal States, in Tuscany, and in Naples, and died as Grand-constable of Naples. His son FRANCESCO: b. 25 July 1401; d. Milan 8 March 1466, received the command of the Milanese forces in the war against Venice. In 1447 he laid claim to the states of Milan in virtue of his wife, although she was only the natural daughter of the last duke, and to enforce his claim concluded a treaty with Venice, and advanced against Milan. He laid siege to the city in 1449, and on 3 March 1450 it was forced by famine to surrender. His son GALEAZZO MARIA: b. 24 Jan. 1444; d. 26 Dec. 1476, a barbarian and a voluptuary, was murdered by conspirators. The son of Galeazzo, GIOVANNI GALEAZZO: b. 1468; d. 1494, never actually ruled. Till 1480 he was subject to the guardianship of his mother and her minister Checco Simonetta. The latter was then beheaded by his uncle Lodovico, surnamed the Moor, in 1541; b. 1510. Lodovico then assumed the government himself, and kept his nephew virtually a prisoner in the castle of Pavia. At a subsequent period he joined the league against France, and was on that account deposed by Louis XII. (1500). He was taken to France where he died. His son MASSIMILIANO: b. 1491; d. 1530, once more drove the French from his territories by the aid of the Swiss, but in consequence of the battle of Marignano was obliged to cede his dominions to Francis I. (1515) in consideration of a pension. The remainder of his life was spent in France. Francis was afterward driven from Italy by the Emperor Charles V., who invested FRANCESCO: b. 1492; d. 24 Oct. 1535,

Digitized by Google

brother of Maximilian, with the Duchy of Milan in 1522. On the death of Francesco in 1535 Charles V. conferred the duchy on his son Philip II., king of Spain. Consult: Corio, 'Historia di Milane' (1565); Verri, 'Storia di Milane' (1851); Hallam, 'View of the State of Europe during the Middle Ages' (1818).

Sgraffito (sgrăf-fē'tō) **Decoration,** that which is produced by means of scoring or scratching on a comparatively soft surface. It is like engraving in all respects except in the relative hardness of the material and the delicacy of the work. There is only one peculiarity in it which is different in nature from the effect produced by engraving, and that is the producing of color effects by scratching through an outer surface so as to show an inner surface of a different hue or tint. Even in this respect it is like a very delicate art of incision, namely, the Japanese method of cutting through different layers of colored lacquer so as to produce decorative patterns. It is also in this respect like the art of cameo-cutting when applied to onyx in layers of black and white, or a similar stratified material.

Sgraffito decoration, in the usual sense, is of two kinds: first, that which is applied to plaster surfaces, as of the outer faces of walls; and secondly, to clay surfaces, as where an earthen pot is scored with a hard point before it is fired. In both of these departments sgraffito decoration is one of the earliest methods applied: and in pottery we have in our museums pieces of pre-historic and primitive work of great interest, while also the art seems one never wholly abandoned when pottery is made cheaply and quickly by people who care for decorative effect. The sgraffito decoration of plaster walls is, however, limited in application to a few epochs of European history. It has never been out of use in Italy since the Middle Ages, and occasionally a new building, even of some pretensions, is adorned in this way, or a monument of the past is carefully restored, with its sgraffito decoration repaired and completed. In the northern lands of Europe the severity of the weather is a partial check on the employment of the art; but the main reason for its neglect is the modern desire for smoothness, finish, and completeness of all sorts, with which the sgraffito process may be thought to be inconsistent. It is clear that a house faced with brown plaster which is deeply scored to show lines of black and white plaster from below, will not meet the requirements of a community respecting nothing which has not the look of expense and deliberation. The effects, however, are very spirited and artistic, and it is a pity that the process is not used for inexpensive building. RUSSELL STURGIS.

Shabbathai Zebi, shä bäth'a-ē zä'bē, Jewish impostor: b. Smyrna July 1641; d. 10 Sept. 1676; was a convert to the fantasies of Isaac Luria, a Cabbalist, who declared that he held intercourse with the prophet Elijah, and that he was the Messiah, the son of David, the true Redeemer. Though he was converted to Mohammedanism (1667) the sect survived, and still acknowledges him as the Messiah. He converted many thousands to a belief in him and his design to restore them to Jerusalem. Commerce and trade were interrupted by this movement and Shabbathai Zebi was brought before the Sultan Mohammed IV., and at the prospect of imminent death renounced his pretensions, embraced Islamism, and received an office under the Sultan. Consult: Milman, 'History of the Jews'; Da Costa, 'Israel and the Gentiles'; Schumaker, 'History of the Modern Jews.'

Shabu'oth, a Jewish feast, known also as the Festival of the Weeks; the most joyous of all the ancient Hebrew holidays. It was originally called the Feast of the Barley.

Shackelton, shăk'l-tŏn, **Robert,** American writer: b. Wisconsin 26 Dec. 1860. He studied law in Michigan, was admitted to the bar in Ohio, followed journalism in New York for five years, and in Philadelphia as associate editor of 'The Saturday Evening Post,' for two. He is the author of 'Toomey and Others' (1900); 'Many Waters' (1902); 'The Great Adventurer' (1904).

Shad, an anadromous fish of the family *Clupeidæ* or herrings (q.v.). This genus is closely allied to the alewives (*Pomolobus*), from which it is distinguished by the very deep head, particularly the cheeks, and by having the upper jaw compressed and grooved to receive the tip of the lower. Four species of true shads have been described, two indigenous to the Atlantic coast of Europe, one to the Atlantic coast of the United States, and the fourth, recently discovered to be distinct, to the Gulf States. The American Atlantic shad (*A. sapidissima*) is the largest of the herrings found in this country, the female exceeding the male and generally weighing at the spawning age three to six pounds, though larger ones are taken. On the Pacific coast, where the shad has been introduced and established, it reaches a greater weight. The body is deep and compressed, especially on the belly, where the scales and their supporting bones form a series of serrations; the scales are large and very easily detached; the mouth toothless and the gill-rakers long and numerous. The numerous slender, pin-like bones, which are such an annoyance at the table, are chiefly several series of intermuscular bones which support the muscle segments above the ribs. There is a narrow lateral strip of dark muscle.

The northern limit of the shad's range is the Gulf of Saint Lawrence, south of which it enters all of the rivers of the Atlantic seaboard unless prevented by some obstruction. Introduced into the Sacramento River by the California and United States Fish Commissions in 1871–80, it has now become abundant on the Pacific coast from Monterey Bay to Alaska. Concerning the habits of the shad during the greater part of its existence in the sea, very little is definitely known. Apparently, from the fact that they are taken frequently with mackerel and other fishes near the coasts, they do not depart very far from the shores. Their structure indicates that they swim near the surface, strain through their gill-rakers the water taken in by the mouth, and retain the minute life which it contains. This food appears, from what few stomach examinations have been made, to consist chiefly of minute crustaceans. Their movements are controlled largely by the temperature of the water and, although the annual migration from the sea to the rivers is solely for the pur-

Digitized by Google

pose of reproduction, it takes place when the temperature of the water lies between 56° and 66°, and is hastened or retarded accordingly by warm or cold seasons. The movement of the schools begins in November and ends in March in the Saint John's River and progresses regularly from south northward as the season advances, the chief runs in the Potomac occurring in April, in the Delaware in April and May, and in the Kennebec in May and June. During the earlier weeks of the migration males predominate, during the later females. The eggs may be deposited anywhere above brackish water, at the mouths of creeks or high up the rivers. No nest is formed or other care given the eggs; the spawn and milt are simply ejected in intermingling streams as the male and female fish swim side by side about the time of sunset. The fertilized eggs are about ⅛ inch in diameter with a water space beneath the egg membrane and, being heavy, sink to the bottom. From 30,000 to 100,000 eggs are taken artificially from each female, but the natural yield is much greater. After spawning, the fish which are lean and starved begin to feed and move sea-ward. The young shad remain in the rivers much longer and do not finally enter the bays and coastal waters until the temperature of the river water approaches 40° when, in November, they are about three inches long. They remain in the sea for three or four years until mature, though a few immature ones often enter the rivers in the spring with herrings or shad, and they have been found on several occasions in shallow bays along the coast. Besides man, the shad has many enemies, and the destruction of the eggs and young by predaceous fishes, and especially by eels, is enormous. Because of this fact and the added one that shad can be caught only before and during the spawning season, and for various other reasons, the shad fisheries had greatly declined and in some places had even been abandoned during the '70s.

To remedy this the United States Fish Commission took up the problem of the artificial propagation of shad and succeeded so well that the fisheries have not only been saved, but greatly extended and at the present time are dependent on this means of maintaining the abundance of this fish. The chief advantage of artificial over natural propagation lies in the much larger percentage of eggs fertilized and hatched. In its perfect state the method is very simple but exact. The spawn-takers enter the boats as the nets are drawn and select and strip with great precision the ripe males and females, the milt being squirted over a layer of eggs in the bottom of a moist pan, after which a small quantity of water is added and the whole gently agitated. The surplus milt is then washed away and eggs carefully washed and cleaned. As the eggs are heavier than the water they are now hatched in a closed McDonald or siphon jar, to which a stream of fresh water is admitted through a glass tube running to the bottom, and the overflow drawn off at the top, thus constantly moving the eggs. They begin to hatch in about a week, though the time varies with the temperature, and as the young fry and nearly hatched eggs rise to the surface they are drawn off automatically at the outlet into larger vessels. With careful attention to details the fry are distributed to the various creeks and rivers a few days after hatching, in some cases the special cars devised for carrying young fish being employed for their transportation. They may, however, be readily reared in ponds, and many have been thus kept for months or even a year before being liberated. The shad-hatching work has now reached enormous proportions. In 1900, for example, the United States Fish Commission hatched and distributed 241,056,000 fry.

The great estimation in which the shad is held as a food-fish has led to the development of this fishery so that it is now exceeded in value only by that of the cod and salmon. In 1896 13,145,395 shad were taken on the Atlantic coast. These weighed 50,847,967 pounds and were sold by the fishermen for $1,656,580, which is about the usual annual product. On the Pacific coast the shad fishery is rapidly growing, having tripled in value between 1895 and 1897. In the latter year it yielded 1,254,801 pounds, valued at $15,898. With the exception of a few pickled and salted the entire catch of shad is consumed fresh. In the sounds, bays, and estuaries many are taken in pound nets and weirs, but in the rivers above their mouths gill nets and seines are the chief means of capture. Some of the great seines in use on the Potomac and Delaware rivers are more than a mile in length and are hauled by means of donkey engines.

Two species of shad are found in Europe, the common or allis shad (*Alosa vulgaris*) and the twaite shad (*A. finta*). The common shad inhabits the sea near the mouths of large rivers, and in the spring ascends them for the purpose of depositing its spawn in the shallow water about their sources. The young fry remain for a season in the waters which gave them birth, but on the approach of cold weather descend the rivers and take refuge in the ocean. The old ones likewise return, and at this time are emaciated and unfit for food. Its color is a dark blue above, with brown and greenish lustres, the under parts being white. The twaite shad is about a half less than the common species, and weighs on an average about two pounds.

Consult: Goode, 'The Fisheries Industries of the United States' (Washington 1884–7); Stevenson, 'The Shad Fisheries of the Atlantic Coast,' Report United States Fish Commission (Washington 1899); Brice, 'A Manual of Fish Culture' (Washington 1897); Cunningham, 'Marketable Marine Fishes' (New York 1896); and the Annual Reports of the United States Bureau of Fisheries. See CLUPEIDÆ; HERRING; POUND-NET FISHING.

Shad-bush. See AMELANCHIER.

Shad-fly, a May-fly (q.v.).

Shad-waiter. See WHITEFISH.

Shad'dock, a small tree (*Citrus decumana*) of the order *Rutaceæ*. It is a native of the Malay Archipelago whence it has been introduced into India, the West Indies, Florida, California, and other warm climates for its fruits. It is a small tree about 25 feet tall with large ovate leaves, large white flowers, and light yellow or pink fruits, with sweet or acid pale yellow or reddish pulp, arranged in sections like those of the orange. In some horticultural varieties the fruits are more than six inches in diameter and weigh more than 10 pounds. The true shaddocks are pear-shaped and are seldom found in the northern markets, since the

Digitized by Google

round fruited kinds or "pomelos" are in America considered more valuable for shipping. The name "grape-fruit" is often applied to the shaddock because it is produced in clusters somewhat resembling grapes. Other popular names are forbidden fruit, fruit of paradise, pumelo, pompelos, and variations of spelling. The tree is somewhat larger than its relative, the orange, and is planted about 30 feet apart. It is found to be most satisfactory when budded upon its own stock or that of the sour or sweet orange, the first being preferred by many growers. It is considered more tender than the orange and in the United States is grown only in the lower part of the Florida peninsula and warmer California. The cultivation, fertilization, and management are practically the same with the above exceptions, to those of the orange and lemon (qq.v.).

Shadoof, an ancient Egyptian contrivance for raising water. It is extensively in use in the East for drawing water for irrigation purposes, and its prototype is found in use in the South in the United States, where it is employed to draw water from the open "surface" wells. The machine consists of a cross-bar on two uprights; suspended on this horizontal bar is a long rod or branch of a tree, so fixed as to work as on a fulcrum, the long end or lever pointing upward and over the water, usually a river or stream, and the short end behind the bar and nearest the ground. On the short end is affixed a weight of rock or dried mud, to act as a counterpoise to the long end. From the end of the long portion a bucket is suspended. When not in use the shadoof naturally rests with the short weighted end next to the ground and the long end, with dependent bucket, in the air. When it is desired to draw water the bucket is pulled down (by a rope attached to the long end) and is dipped under the water; on account of the weight at the other end it is now easy to tip the shadoof, again bringing the bucket into the air where it can be poured into any object on the bank desired,— often a hole, from which a runnel conveys the water to irrigation ditches. Shadoofs are often made two or more, side by side, or a succession of them along the bank to be used at different stages of the water.

Shadow, the darkness caused by the interposition of an opaque substance between a luminous point or body and the place upon which the shadow is thrown. When the substance that casts the shadow is in open space, the form of the shadow is that of a section of the substance made at right angles to the direction of the ray of light. When the body casting the shadow is larger than that which emits the light the shadow goes on constantly increasing in diameter the further it goes; when it is of the same size with the latter, the shadow is unlimited in length, but always remains of the same diameter; and when it is smaller the shadow gradually diminishes to a point, where it terminates.

Shad'well, Charles Lancelot, English lawyer and author: b. London, England, 16 Dec. 1840. He was educated at Christ Church, Oxford, was called to the bar of Lincoln's Inn in 1872, and has published: 'The Laudian Statutes' (1888); 'History of Oriel College' (1891); 'The Earthly Paradise' (1899); 'Registrum Orielense' (2 vols. 1893–1902); 'The Purgatory of Dante Translated in English Verse' (1892); etc.

Shadwell, Thomas, English dramatist: b. Stanton Hall, Norfolk, about 1640; d. London 19 Nov. 1692. He was educated at Cambridge, and subsequently studied law. His comedy, 'The Sullen Lovers' (1668), was successful and he thereafter devoted himself to literature. He wrote 17 plays, the most of them modeled on the style of Ben Jonson, which caricatured with genuine humor, though somewhat coarsely, various eccentricities in the manners of the day. After the Revolution he became in 1693 poet-laureate and royal historiographer, succeeding Dryden and thereby incurring the enmity of that poet, who made him the hero of his clever satire 'MacFlecknoe.' His death was supposed to be due to an overdose of opium. His poetry was of little merit, but his dramatic pieces, though of only temporary reputation were much lauded in their day. They include: 'The Virtuoso' (1676); 'Lancashire Witches' (1682); 'Volunteers, or the Stock-jobbers' (1693); etc. His collected 'Works' were published in four volumes (1720).

Shaff'ner, Taliaferro Preston, American inventor: b. Smithfield, Va., 1818; d. Troy, N. Y., 11 Dec. 1881. He studied law and was admitted to the bar, but practised little, his attention being largely absorbed by inventions. In the early days of the telegraph he was an associate of Samuel F. B. Morse. He built the line from Louisville, Ky., to New Orleans and that from Saint Louis to Jefferson City in 1851. He projected a North Atlantic cable that should touch Labrador, Greenland, and Iceland, and secured a number of patents for the use of high explosives in blasting. During the Dano-Prussian war of 1861 he was in the service of Denmark. He published the 'Telegraph Companion: devoted to the Science and Art of the Morse American Telegraph' (1855); 'The Telegraph Manual' (1859); 'The Secession War in America' (1862); 'History of America' (1863); 'Odd Fellowship' (1875).

Shafter, shăf'tėr, **William Rufus,** American military officer: b. Galesburg, Mich., 16 Oct. 1835; d. near Bakersfield, Cal., 12 Nov. 1906. At the outbreak of the Civil War he entered the 7th Michigan Infantry. He participated in the battles of Fair Oaks, Savage Station, Glendale, and Malvern Hill; was appointed major 5 Sept. 1862; was taken prisoner at Thompson's Station, Tenn., in March 1863, and exchanged in May of the same year; was made lieutenant-colonel 5 June 1863, and became colonel of the 17th United States colored troops 19 April 1864; brevet brigadier-general of volunteers for gallant and meritorious services during the War; and was mustered out of the volunteer service 2 Nov. 1865. He entered the regular army and became lieutenant-colonel of the 41st Infantry 26 Jan 1867; assigned to the 24th Infantry 14 April 1869; colonel of 1st Infantry 4 March 1879; and brigadier-general 3 May 1897. On the breaking out of the Spanish-American war he was given command of the army mobilized for the invasion of Cuba; his first decisive move was the landing of 16,000 men in Cuba in about 12 hours without an accident. He conducted the military operations resulting in the surrender of Santiago de Cuba. After the war

Digitized by Google

he commanded the department of California and Columbia in 1899–1901, and was retired 3 June 1901.

Shaftesbury, shäfts'bŭ-rĭ, **Anthony Ashley Cooper**, 1st Earl of, English statesman: b. Wimborne Saint Giles, Dorsetshire, 22 July 1621; d. Amsterdam 21 Jan. 1683. He entered Exeter College, Oxford, whence he removed to Lincoln's Inn, with a view to the study of law; but was chosen representative for Tewkesbury in 1640. At the commencement of the civil war he sided with the king's party, though he appeared to deem mutual concession necessary. Finding himself in consequence of this opinion distrusted by the court he went over to the Parliament, from which he received the command of the parliamentary forces in Dorsetshire. When Cromwell turned out the Long Parliament, Sir Anthony was one of the members of the convention which succeeded. He was, nevertheless, a subscriber to the protestation which charged the Protector with arbitrary government, though this fact did not prevent him from becoming one of his privy-council. After the deposition of Richard Cromwell he was privately engaged in a plan for the restoration of Charles II., which he subsequently aided with all his influence. He was one of the 12 members of the convention of 1660 who carried the invitation to the king, and was soon after made a privy-councillor, and a commissioner for the trial of the regicides. In 1661 he was raised to the peerage by the title of Baron Ashley, and appointed chancellor of the exchequer and a lord of the treasury. Yet he gave his strenuous opposition to two of the leading measures favored by the crown, the Corporation act in 1661, and the act of Uniformity in 1662. Afterward his conduct changed, and he was one of the members of the obnoxious Cabal (q.v.). He supported the Dutch war, and issued illegal writs for the election of members of Parliament during a recess, and in 1673 supported the Test act. In 1672 he was created Earl of Shaftesbury and lord high-chancellor. His conduct on the bench was able and impartial. He had not, however, been a whole year in office when the seals were taken from him, probably through the influence of the Duke of York; and from that moment he became one of the most powerful leaders of the opposition. He made use of the Popish plot to force out the Earl of Danby's administration (1678), and produce the formation of a new one, in which he was himself made president of the council April 1679. Amid many violent party proceedings which followed, the Habeas Corpus act was passed. He remained in the administration only until October. In his hostility to the Duke of York Shaftesbury is now supposed to have entered into connection with the Duke of Monmouth, with the view of supporting his claims to the crown, a circumstance which gave rise to Dryden's satire of 'Absalom and Achitophel.' In consequence of this suspected design Shaftesbury was once more committed to the Tower, and tried for high treason; but the grand jury before whom the bill of indictment was laid ignored it. Not long after this acquittal the earl withdrew to Holland, where he died. He was widely accomplished, and easily the greatest politician and governor of parties in his time in England. Consult the biographies by Christie (1871) and Traill (1886); also Macaulay's 'History' (1848–55).

Shaftesbury, Anthony Ashley Cooper, 3d Earl of, English moral philosopher: b. London 26 Feb. 1701; d. Naples 15 Feb. 1713. He was grandson of the preceding. After travel in Germany, France, and Italy, he became (1695) the representative in Parliament of Poole, in Dorsetshire, and distinguished himself while in Parliament by his support of measures favorable to public liberty. In 1698 he gave up his seat, and visiting Holland in the assumed character of a student of physic, he prosecuted his studies, and became intimately acquainted with Bayle, Le Clerc, and other literary men. In 1709 he published an 'Essay on the Freedom of Wit and Humor,' an 'Inquiry Concerning Virtue or Merit,' and 'The Moralist, a Philosophical Rhapsody,' being an eloquent defense of the doctrine of a Deity and providence. His 'Sensus Communis,' and his 'Soliloquy, or Advice to an Author,' followed in 1710. At the time of his death he was engaged in a work on the 'Arts of Design.' His works were collected and published together, under the title of 'Characteristics of Men, Manners, Opinions, and Times' (1711; rev. ed. 1714). A new edition by Hatch began to appear in 1870, but was never finished. As a writer he is remarkable for the elegance but also for the excessive artificiality of his style. In all his works Lord Shaftesbury appears a zealous advocate for liberty, and a firm believer in the fundamental doctrines of natural religion; but, although he professed a respect for Christianity, he was doubtless skeptical in regard to revelation. Consult the works by Spicker (1872), von Gizycki (1876); Fowler, 'Shaftesbury and Hutcheson' (1882); also Rand, 'Unpublished Letters and Philosophical Regimen of the 3d Earl of Shaftesbury' (1900).

Shaftesbury, Anthony Ashley Cooper, 7th Earl of, English philanthropist: b. London 28 April 1801; d. Folkestone, Kent, 1 Oct. 1885. He was educated at Harrow and Oxford, and sat in the House of Commons during most of the period from 1826 to 1851, as member successively for Woodstock, Dorchester, Dorsetshire, and Bath, but in the latter year succeeded to the peerage. He supported the administrations of Liverpool and Canning, and in 1828 he was appointed a commissioner of the board of control. Six years later he became a lord of the admiralty under Sir Robert Peel. From 1828, when he was appointed a member of a committee of inquiry into the treatment of lunatics, he constantly strove to improve the lunacy laws and administration; and it is largely due to his efforts that most of the worst abuses have been removed. But his name must ever be chiefly associated with his noble and successful efforts to improve the condition of factory workers. About 1833 he first proposed the limitation of their working-day to ten hours, and in spite of opposition his proposal became law in 1847. In 1842 an act was passed under his direction for the improvement of the condition of colliery workers.

Though a Conservative, he supported the repeal of the corn-laws. For 39 years he acted as chairman of the Ragged School Union, and he was also identified with various movements

Digitized by Google

for securing better house accommodation for the working classes. He was president of the Bible Society, of the Pastoral Aid Society, of the Protestant Alliance, and of other religious organizations. He was an ardent evangelical in religious matters, and opposed to rationalistic beliefs and ritualistic practices. He published a volume of 'Speeches' (1868). Consult Hodder, 'Life and Work of the Earl of Shaftesbury' (1886).

Shag, a cormorant (q.v.).

Shagreen', a kind of grained leather, of a close and solid substance, used for forming covers for cases, etc., which easily receives different colors. It is prepared in the East from the skins of wild asses, horses, and camels. The most common color is sea-green (given by means of copper-filings and a solution of sal-ammoniac); but blue, red, black, and other colors are also given it. Shagreen is also made of the skins of the sea-otter, seal, etc.

Shah, the title given by western writers to the sovereign of Persia; in his own country he is known by the compound title Padishah. It is also used in other countries of central and southern Asia, and signifies a sovereign prince or king.

Shah Alum (Alam, Alem) II., emperor of Delhi: d. 1806. He was the last of the Mogul emperors to exercise even a nominal independence and ascended the throne in 1759. For 12 years he was exiled and he finally, in the endeavor to strengthen his authority over his empire, sought British friendship and granted to them Bengal, Bahar, and Oressa in exchange for the city and district of Allahabad. He put himself under the power of the Mahrattas in 1771, but in 1788 Delhi was seized by the Mohammedan rebel, Ghulam Kadir, who put out the emperor's eyes. From 1803–6, under the protection of Lord Lake, who had defeated the Mahrattas, Shah Alum enjoyed a period of comparative affluence, thus peacefully ending his long and wretched reign.

Shah-Jehan, shäh yĕ-hän'. See INDIA, *History*.

Shahaptian (shă-hăp'te-an) **Indians,** a linguistic stock of North American Indians, the name of which is adapted from the Kootenay name of the Nez Percés, one of its principal tribes. The divisions of the stock occupied a large section of country along the Columbia and its tributaries in what is now northeastern Oregon, southeastern Washington, and southwestern Idaho, extending from about lon. 114° 30' to 121°, and between lat. 44° and 46°. Their western boundary was the Cascade Mountains; their westernmost bands, the Klikitat on the north, the Tyigh and Warm Springs on the south, enveloping for a short distance the Chinookan territory along the Columbia which extended to the Dalles. Shahaptian tribes extended along the tributaries of the Columbia for a considerable distance, especially along Snake River, their eastern boundary being interrupted by the Bitter-root Mountains. The customs and habits of the tribes composing the stock were fairly homogeneous, the family organization was loose, and the clan system did not prevail. They subsisted chiefly on salmon and on roots and berries, and after the introduction of the horse did more or less hunting. Agriculture was not engaged in, and the villages were of a temporary character owing to the necessity of frequently shifting residence in search of food. With the exception of the outbreak of the Nez Percés under Chief Joseph in 1877, due to the failure of the government to fulfil its treaty obligations with the Indians, the Shahaptian tribes have been generally peaceful. The principal tribes or bands of the stock, with their present location, are: Yakima, 2,311 under Yakima agency, Washington, and perhaps 300 not under an agent; Nez Percé (Chopunnish), 1,567 under Nez Percé agency, Idaho, and 126 under Colville agency, Washington, total, 1,693; Klikitat, about 165 under Yakima agency, Washington; Paloos, unknown number under same agency; Tenaino, 70 under Warm Springs agency, Oregon; Tyigh, about 430 under same agency; Umatilla, 184 under Umatilla agency, Oregon; Wallawalla, 525 under same agency; Tukspush or John Day Indians, about 60 under Warm Springs agency.

Sháhjehánpur, shä-jĕ-hän'poor, India, chief town and administrative headquarters of a district, 100 miles northwest of Lucknow. Some fine mosques and the ruins of an ancient castle, are its most interesting architectural features. Its chief industry is agriculture and the export trade consists of sugar, pulses and cereals. The town was founded in 1647 by the Mogul emperor, whose name it bears. In the mutiny of 1857–8, it was one of the active seats of the rebellion.

Shairp, shärp, **John Campbell,** Scottish poet and miscellaneous writer: b. Houston, West Lothian, 30 July 1819; d. Ormsary, Argyllshire, 18 Sept. 1885. He was educated at Glasgow University and Balliol College, Oxford, and after a term as assistant-master at Rugby was appointed assistant professor of Latin at Saint Andrews in 1857 and professor in 1861. In 1868 he was made principal, and thereafter was generally known as "Principal" Shairp. From 1877 he also held the chair of poetry at Oxford. As a critic and expositor Shairp was markedly illuminating and careful. His works consist of 'Kilmahoe, a Highland Pastoral, and other Poems' (1864); 'Studies in Poetry and Philosophy,' including essays on Wordsworth, Coleridge, and Keble, which furnish some of the best of his writings (1868; 4th ed., 1886); 'Culture and Religion' (1870); 'Life and Letters of J. D. Forbes' (1873), with Tait; 'Poetic Interpretation of Nature' (1877); 'Burns' (1879); 'Aspects of Poetry' (1881). Posthumous collections are: 'Sketches in History and Poetry' (1887), edited by Veitch; and 'Glen Desseray and other Poems' (1888), edited by Pelgrave. Consult: Knight, 'Principal Shairp and his Friends' (1888); Sellars, 'Portraits of Friends' (1889); and the article by Dean Boyle in the 'Guardian' for 30 Sept. 1885.

Shakers, the common name of the United Society of True Believers in Christ's Second Appearing. The name originated in the somewhat violent and irregular motions — leaping, shouting, etc.,— which were once a part of their worship, but which are so no longer, the motions of the Shakers at worship in these days being uniform and regular, and without sensational features. Although originating in Eng-

Digitized by Google

land the sect is wholly American, and presents in its several communities an interesting example of thrift, industry, and good morals.

The founder of the Shaker sect was Ann Lee, born at Manchester, England, in 1736. Her father was a blacksmith, and she became at an early age the wife of a blacksmith. She was converted in 1758 by the preaching of Jane Wardlaw, a member of the Society of Friends, who exhorted the people to repent of their sins, declaring that the end of all things was at hand, that Christ was about to reign, and that his second appearance would be in a woman's form. Ann Lee also preached, and was put in prison at Manchester on a charge of disturbing the public peace. When released she began preaching again, and announced that the Lord Jesus had stood before her in prison, and had become one with her in form and spirit. She called herself «Ann the Word,» but her followers gave her the title of «Mother Ann.» She was persecuted and annoyed to such a degree that she emigrated to America with seven companions, and formed the first Shaker settlement at Water Vliet, near Albany, N. Y. Here she also endured imprisonment with some of her followers who refused to bear arms in the War of Independence, on the ground that it was against their principles to serve as soldiers. Ann Lee died 8 Sept. 1784, having witnessed the founding of two new Shaker communities, one at Hancock, the other on Mount Lebanon, New Lebanon, N. Y., the first Shaker meeting house being established in the year following her death, at Mount Lebanon, which is still the most flourishing of the Shaker communities. Joseph Meacham, one of Ann Lee's successors, gave to the Shakers their effective organization, which combines thorough business methods with strict adherence to the principles of their faith. There is no marriage, the two sexes occupying rooms in separate parts of houses, and when married couples join the society, they regard each other as brothers and sisters only. The men do the work of farm and garden, factory and shop, and some widely extended industries owe their origin to the inventive ability of the Shakers. The women cook and attend to the housework, every room being a model of cleanliness. They do much of the tailoring and repairing; prepare seeds and medicines for market, and make butter and cheese. Everybody is occupied, and there is no room or attraction for drones.

Alcoholic liquors are known only as a medicine, and good health is so general that there is but little need for medicine of any kind. The use of tobacco is tabooed, and the diet, while both generous and varied, does not include flesh-meat or fish. The fact that Shakers live, as a rule, to an advanced age, and enjoy excellent health, is adduced in favor of abstinence from meat. It is also noted as significant that none of the Shakers suffer from cancer

The Shaker belief agrees in certain respects with that of the Quakers, from whom the original Shakers were an offshoot. They give due respect to the civil law, but they reject ecclesiastical supremacy and military service. Members of the sect who had previously served as soldiers have refused to accept pensions after joining the Shaker community, and it was largely, if not chiefly on evidence of this fact that President Lincoln ordered the release of Shakers who had been imprisoned for refusing to serve, when drafted for the civil war. The sum saved to the government in the refusal to accept pensions would have more than paid for substitutes for the Shakers who had been drafted.

The Shakers believe that God is king; that the sin of Adam is atoned, and that man is free of all errors except his own; that every human being will be saved, and that the earth is heaven, now soiled and stained, but ready to be brightened by love and labor. They believe in the immediate revelations of the Holy Ghost, and they regard angels and other spirits as maintaining companionship and intercourse with those who have been purified and exalted by the gifts of grace. Shakers believe that at death they merely throw off the bodily garment, and change the form of their existence, but no more. They expect no resurrection of the body, the spirit, when it has left the mortal frame being done with it.

The Shakers are steadily diminishing in numbers. At its greatest their membership was 4,869; and it is now about 1,000, in 15 societies, distributed over the States of New York, Massachusetts, New Hampshire, Maine, Connecticut, Ohio, and Kentucky. Elder Daniel Offord is the present head of the Shakers, having been chosen to that office upon the resignation of Elder Levi Shaw, at 83 years of age, in January 1904.

Shakespeare, shāk'spēr, **William,** English dramatic poet: b. Stratford-on-Avon, Warwickshire, in April (?) 1564; d. there 23 April 1616. About a century ago, George Steevens, one of the most eminent Shakespearian editors and critics of that period, wrote thus: «All that we know with any degree of certainty concerning Shakespeare is — that he was born at Stratford-on-Avon, married, and had children there; went to London, where he commenced actor, and wrote poems and plays; returned to Stratford, made his will, died, and was buried.» And Tennyson is reputed to have said: «The world should be thankful there are but five facts absolutely known to us about Shakespeare: the date of his birth, 23 April 1564; his marriage at 19 to Ann Hathaway; his connection with the Globe Theatre, and with Blackfriars; his retirement from theatrical life, with a competency, to Stratford; and the date of his death, which took place upon the anniversary of his birth, 1616.»

If this were strictly true, however, it should be understood that there is nothing exceptional in it, though certain writers who deny that Shakespeare wrote the works ascribed to him have laid much stress upon it. The biographies of the great majority of literary men of that time, especially the dramatists, are as meagre as Shakespeare's. In the latest sketch of the lives of Beaumont and Fletcher (in the 'Mermaid' series of English dramatic writers) the editor says: «Beaumont and Fletcher, though not of obscure origin, like the greater number of their fellow dramatists, yet afford no exception to the general rule in the obscurity that surrounds their lives.» The volume of the same series devoted to Webster and Tourneur begins thus: «Nothing is known about the lives of

Digitized by Google

WILLIAM SHAKESPEARE.

Digitized by Google

Digitized by Google

John Webster and Cyril Tourneur. We are ignorant where they were born and when they died," etc. The history of Marlowe, Massinger, and other prominent dramatists of the period is much the same, as reference to their names in the present work will show.

This is also true, as already intimated, of other great authors than playwrights. Prof. Hales begins his biographical sketch of Spenser ('Globe' ed. of his works) thus: "The life of Spenser is wrapt in a similar obscurity to that which hides from us his great predecessor Chaucer, and his greater contemporary Shakespeare. . . . The birth-year of each poet is determined by inference. The circumstances in which each died are a matter of controversy. What sure information we have of the lives of each one is scanty and interrupted."

These quotations might be multiplied if space permitted. It is clear, therefore, that no theory or argument concerning the authenticity of the works of Shakespeare can be based upon the lack of information concerning the man.

Our positive knowledge of Shakespeare's personal history, however, is by no means so limited as Steevens and Tennyson represent. The investigations of the last 50 or 60 years in municipal, theatrical, and other records, in the literature of the Elizabethan and succeeding periods, and in other sources of information, have brought to light a multitude of indisputable facts concerning the man and his works.

Unfortunately, the first biography of Shakespeare worthy of the name was not written until 1709, or nearly a century after his death, being prepared by Nicholas Rowe as an introduction to his edition of the poet's works. It was based mainly upon the researches of Betterton, the actor, who a few years earlier had visited Stratford for the express purpose of ascertaining what could be learned there about the personal history of the dramatist. He communicated the results of his investigations to Rowe, to whom we are indebted for the preservation of these and other fragments of information which otherwise would have been lost. Rowe appears to have exercised great caution in dealing with his materials, discriminating carefully between what he regarded as established fact and as doubtful tradition. A few errors have been detected in the minor details that he gives, but the more important particulars have been verified by later researches.

For almost a century after the appearance of Rowe's 'Life' no serious attempt was made to improve upon it. Pope, Johnson, and Steevens, in the biographical sketches prefixed to their editions of Shakespeare, substantially repeated Rowe's matter. Edmund Malone was the first to attempt a biography on a more extended scale. In the introductions to the 'Variorum' editions of 1803, 1813, and 1821, he presented a large amount of new information, based on his researches in the Stratford archives, the manuscripts collected by the actor and manager, Edward Alleyn, at Dulwich, and official records and documents in London. His 'Life of Shakespeare,' as completed and published in the 'Variorum' of 1821, fills 287 octavo pages; and to this the discussion of the chronological order of the plays adds 180 pages more.

Of the many contributions to Shakespearian biography since the time of Malone, the most important have been made by Mr. Halliwell-Phillipps, who, between 1850 and his death in 1889, continued the examination of the ancient records and documents likely to throw light upon the subject, and printed the results in successive publications and finally in the monumental work in two royal octavo volumes which he modestly entitled 'Outlines of the Life of Shakespeare,' the 9th edition of which was issued in 1890. Mr. Sidney Lee's 'Life of Shakespeare' (1898) is the most noteworthy of the other biographies published in the last half-century.

Of Tennyson's "five facts" the first is a mere conjecture. William Shakespeare was baptized, as the parish record proves, on 26 April (O. S.), but the date of his birth is not known. It has been assumed that it was 23 April (3 May by the New Style calendar) because babies were often baptized three days after birth. The only other evidence bearing on the case is the inscription on the poet's monument at Stratford, which tells us that he died 23 April 1616, in the 53d year of his age. If he died on the anniversary of his birth, it might be said, according to the usage of the time, that he was in his 53d year; but the inscription *proves* nothing except that he could not have been born later than 23 April 1564.

John Shakespeare, the poet's father, was of the yeoman class, and had been a farmer in a neighboring village before he came to Stratford about 1553, and adopted the trade of a "glover," dealing also in wool and agricultural produce, with which his former occupation made him familiar. His ability and public spirit are shown by his rapid success in business, which soon enabled him to buy two houses in Stratford, and by his rising through the lower grades of office to that of high bailiff, or mayor, of the town in 1568. His wife, Mary Arden, belonged to a minor branch of an old Warwickshire family, and inherited a considerable estate from her father.

John and Mary Shakespeare had four sons and four daughters. William was the third child, but the eldest son. Of his early years nothing is known, but it is probable that at the age of seven (the earliest at which he could be admitted) he entered the Stratford Grammar School, an ancient institution which, after being closed for some years on account of the dissolution of the local Guild, on whose revenues it was dependent, by Henry VIII. in 1547, was re-established by Edward VI. in 1553 as "The King's New School of Stratford-upon-Avon." The masters of the school in the poet's boyhood were university men of good scholarship. The studies were mainly Latin, with writing and arithmetic, and possibly a little Greek, which was sometimes taught in the grammar schools at that time. Ben Jonson credits Shakespeare with "small Latin and less Greek"; and we may be quite certain that the boy had no regular schooling except what he got at Stratford. It is evident from his works that he had not the learning which a few of the critics have ascribed to him. His quotations from Latin literature are such as a schoolboy might make from Virgil, Ovid, and the other authors he had studied; and his allusions to classical history and mythology are mostly from the same

Digitized by Google

sources, or from the familiar stock in English books of the period. The historical materials of his plays are evidently from a very limited number of English authorities, like Holinshed's 'Chronicles' and North's 'Plutarch'; and in the use of these he often makes mistakes of which an average scholar could never be guilty.

It should be understood that the notion that Shakespeare was a learned man is of comparatively modern date. In the references to the dramatist in the literature of his day and for a century after his death (as carefully collected by the New Shakspere Society of London) there is no hint of it, while expressions of the contrary opinion are frequent. John Hales of Eton, writing before 1633, and referring to a conversation concerning Shakespeare in which Sir John Suckling, Sir William Davenant, Ben Jonson, and he himself were engaged, says that, «hearing Ben frequently reproaching him [Shakespeare] with the want of learning and ignorance of the ancients,» he [Hales] «told him that, if Mr. Shakespeare had not read the ancients, he had likewise not stolen anything from them (a fault the other made no conscience of), and that, if he would produce any one topic finely treated by any of them, he would undertake to find something upon the same subject at least as well written by Shakespeare.»

Jasper Mayne, writing in 1637, mentions Shakespeare among the dramatists who did their work «without Latin helps.» H. Ramsay, also in 1637, complimenting Ben Jonson for his knowledge of Latin and Greek, says that he

> could command
> That which your Shakespeare could scarce understand.

Leonard Digges, in the verses prefixed to the 1640 edition of Shakespeare's 'Poems,' compliments him for his «Art without art, unparalleled as yet,» and adds that he borrows nothing from Greek or Latin; yet, as he says, Shakespeare's 'Julius Cæsar' ravished the audience,

> When some new day they would not brook a line
> Of tedious (though well labour'd) *Catiline;*

and «'Sejanus' too was irksome»— referring to Ben Jonson's Roman plays.

The learned Fuller, in his 'Worthies' (probably written about 1642), says of Shakespeare: «He was an eminent instance of the truth of that rule, *Poeta non fit, sed nascitur;* one is not *made* but *born* a poet. Indeed his learning was very little; . . . nature itself was all the *art* which was used on him.» Then follows the familiar passage about «the wit combats between him and Ben Jonson, which two I behold like a Spanish great galleon and an English man-of-war. Master Jonson (like the former) was built far higher in learning; solid but slow in his performances: Shakespeare, with the English man-of-war, lesser in bulk but lighter in sailing, could turn with all tides, tack about, and take advantage of all winds, by the quickness of his wit and invention.»

Lady Margaret Cavendish, in the 'General Prologue' to her 'Plays' (1662), after praising Ben Jonson, says:

> Yet gentle Shakespeare had a fluent wit,
> Although less learning, yet full well he writ;
> For all his plays were writ by Nature's light, etc.

Dryden, in his 'Essay on Dramatic Poesy' (1668), says of Shakespeare: «Those who accuse him to have wanted learning, give him the greater commendation; he needed not the spectacles of books to read Nature; he looked inwards and found her there.»

The same great critic, in a prologue to Shakespeare's 'Julius Cæsar' in 1672, says of the author of the play:

> So in this Cæsar which to-day you see,
> Tully ne'er spoke as he makes Antony.
> Those then that tax his learning are to blame;
> He knew the thing, but did not know the name.
> Great Jonson did that ignorance adore,
> And tho' he envied much, admired him more.

Writing again in prose, he alludes to Shakespeare as «wanting that learning and care which Jonson had.»

Gerard Langbaine, in his 'Account of the English Dramatic Poets' (1691), says that Shakespeare «was as much a stranger to French as Latin,» and that «'t is agreed that his learning was not extraordinary»; and yet he ranks «his plays beyond any that have ever been published in our language.»

These quotations might be multiplied, but enough have been given to show what was the universal opinion of the best critical judges in the 17th century concerning Shakespeare's lack of learning. Nature, or *genius,* they all agree, more than made up for the deficiency.

The single slight hint of the opposite opinion in writers of the 17th century is in an 'Address' by Nahum Tate (noted for his bad «new-modelling» of 'Lear' and other plays of Shakespeare), printed in 1680. He says: «What I have said concerning the necessity of learning to make a complete poet may seem inconsistent with my reverence for our Shakespeare. I confess I could never get a true account of his learning, and am apt to think it more than common report allows him. But, however it fared with our author for book-learning, 't is evident that no man was better studied in men and things, the most useful knowledge for a dramatic writer.» We see that Tate had failed in his endeavor to find proof of Shakespeare's learning, thus indirectly confirming the unanimous testimony of the critics of that time to the contrary.

About the middle of the 18th century, John Upton, the elder George Coleman, and a few other critics took the ground that certain passages in the plays indicated an acquaintance with Greek, Latin, and later foreign authors whose works had not been translated into English when Shakespeare wrote; but they were completely refuted by Richard Farmer, in his famous 'Essay on the Learning of Shakespeare,' published in 1766. Dr. Warton refers to it as «a work by which an end is put forever to the dispute concerning the learning of Shakespeare It did settle the question until the Baconian heretics revived it and made it the corner-stone of their theory.

Shakespeare's real education, as Tate intimates, was in the study of «men and things.» His early years were spent in the heart of rural England, where he became familiar with woodland scenery and life, and imbibed the love of nature which is one of his most marked characteristics. There also he got the minute knowledge of the practical side of country life which has furnished material for many volumes

Digitized by Google

on the plant-lore and garden-craft illustrated in his works, and on his familiarity with hawking, hunting, fishing, and the habits of English birds and animals. Warwickshire was, moreover, rich in historical associations. The castles of Kenilworth and Warwick had been centres of political and military interest during the civil wars of the 13th and 15th centuries. Queen Elizabeth's famous visit to the Earl of Leicester at Kenilworth occurred in 1575, when Shakespeare was eleven, and his father, who was then a magistrate at Stratford, may have taken the boy with him to see something of the pageant which attracted throngs of visitors from all the region roundabout. The legendary and romantic lore of the district, in which the redoubtable Guy of Warwick was the chief hero, must also have stirred and stimulated the poet's youthful imagination. Coventry, in the same county, was renowned for its old religious plays, which were not entirely suppressed until 1580; and traveling companies of players visited Stratford when he was five years old and frequently during his boyhood and youth. He must have witnessed these local performances, if not some of those at Coventry, and we can imagine how they developed his taste and love for the drama. The training in the grammar school was an insignificant part of his early education compared with what he got outside of its ancient walls.

It is not improbable that he left school when he was thirteen. About that time his father's fortunes were declining, probably on account of the general depression in trade, and he may have needed the boy's help in his business or have found other work for him. An improbable tradition says that he was bound apprentice to a butcher, but later ran away to London. According to another tradition, he was an attorney's clerk for a time; and the knowledge of law shown in his works has led Lord Campbell and other professional critics to give credit to this story. Judge Allen, however, in his 'Notes on the Bacon-Shakespeare Question' (Boston 1900), has shown that similar familiarity with legal technicalities appears in the works of contemporary dramatists, and that Shakespeare often makes mistakes in these matters which no lawyer or student of law could be guilty of.

Shakespeare's marriage, when he was between eighteen and nineteen, is the next fact in his history of which we have positive proof. The bride, Ann Hathaway, was about eight years older. She was the daughter of a farmer in the neighboring village of Shottery, and the house in which her father, Richard Hathaway, is supposed to have lived, was bought in 1892, as Shakespeare's birthplace in Stratford had been bought in 1848, for preservation in memory of the poet. The marriage probably took place early in December 1582, a bond, authorizing it "with once asking of the bans" being still extant in the Episcopal archives of Worcester, the diocese in which the parties resided. The bond bears the date of 28 Nov. 1582, but no record of the marriage, which was doubtless in one of the neighboring villages, has survived the risks to which English parish registers were often exposed. A daughter was born to the pair the next May, her baptism with the name Susanna being recorded at Stratford on Sunday, 26 May 1583 Twin children, Hamnet and Judith, were baptized 2 Feb. 1585, about two months before their father was twenty-one.

The marriage had evidently been a hurried one, urged on by the relatives of the bride, but apparently not favored by those of the bridegroom, who could not honorably avoid it, and seems not to have been inclined to do so. Some biographers believe that the couple had been formally betrothed some months before the marriage, according to the custom of the time; and this is by no means improbable. The betrothal was then a legal ceremony, consisting in the interchange of rings, kissing, and joining hands, in the presence of witnesses, and often before a priest. Violation of the contract was punished by the ecclesiastical law with excommunication; and the betrothal was a legal bar to marriage with another person, except by the joint consent of the parties. In Shakespeare's time, at least among the common people, it was often regarded as conferring the rights and privileges of the more formal union that was to follow; but later in the century the Church authorities condemned this license. There may have been such a pre-contract, or betrothal, in the case of William and Ann. In the absence of any positive testimony to the contrary, it is no more than fair to allow them the benefit of the doubt.

It is an interesting fact that this ancient betrothal is introduced by Shakespeare in at least seven of his plays,— 'The Two Gentlemen of Verona,' 'The Taming of the Shrew,' 'Twelfth Night,' 'The Winter's Tale' (twice), 'Much Ado,' 'Measure for Measure,' and 'King John.' In 'Twelfth Night,' Olivia, who has been betrothed to Sebastian, supposing him to be the disguised Viola, addresses the latter as "husband," and justifies herself by appealing to the priest before whom the ceremony had been performed, with the understanding that it was to be kept secret until the marriage should take place. Similarly, Robert Arden, the poet's maternal grandfather, in a legal document, calls his daughter Agnes the wife (*uxor*) of the man to whom she was married three months later.

Of Shakespeare's life after his marriage until he went to London nothing further is known. How he managed to support his family we cannot guess. He could have little or no assistance from his father, who, in his reduced circumstances, could barely take care of his own household in which there were now four younger children. William soon decided to leave his wife and babes in Stratford — or perhaps at Shottery with Mrs. Hathaway, then a widow with a comfortable house and income — and to try his fortune in London. The precise date of this move is uncertain, but it was probably in the latter part of 1585 or early in 1586. He came of age in 1585, and that fact may have influenced him in making the venture. Tradition says that about this time he was caught in deer-stealing on Sir Thomas Lucy's estate, and that his departure for the metropolis was prompted or hastened by the prosecution that followed the offense. That the poaching tradition was founded on fact is quite certain from the evidence in '2 Henry IV.' and the 'Merry Wives of Windsor' that Lucy is caricatured as Justice Shallow. The "dozen white luces" in the latter play were apparently suggested by the

Digitized by Google

three luces, or pikes, in the arms of the Lucy family; and the allusions to poaching in the context are equally significant.

What Shakespeare found to do on his arrival in London we do not know. The tradition that at first he held horses at the door of the theatre, said to have originated with Sir William Davenant, is not improbable, as it was then common for gentlemen to go to the theatre on horseback. We know that somehow the young man soon got into one of the two playhouses then established in London — the Theatre and the Curtain — where he doubtless had to begin in some humble capacity. According to tradition, he was first employed as a «prompter's attendant, whose duty it was to give the performers notice to be ready to enter» on the stage. Soon, however, his abilities must have been recognized, and he began his career of an actor in small parts, gradually working his way up to a better position in the company.

If he went to London in 1585, seven years elapsed before we have any positive information about him, or even any tradition worth mentioning except that of his holding horses at the door of the threatre and his first employment inside as «call-boy.» At length, in 1592, we hear about him through a contemporary playwright, Robert Greene, who died in the autumn of that year, leaving a little book, 'Greens Groatsworth of Wit, bought with a Million of Repentance,' to be published after his decease. After referring to some of his fellow dramatists, Greene says of the actors: «Yes, trust them not, for there is an upstart crow, beautified with our feathers, that, with his *Tygers heart wrapt in a Players hide,* supposes he is as well able to bombast out a blanke verse as the best of you; and being an absolute Johannes Factotum, is in his owne conceit the only Shake-scene in a countrie.» That the epithet of «Shake-scene» refers to Shakespeare cannot be doubted, and the passage implies that he was both actor and author, and perhaps plagiarist also. «Beautified with our feathers,» as some believe, may refer to plagiarism, but it may simply mean gaining credit by acting what others have written. The italicized quotation is a parody of «O tiger's heart wrapt in a woman's hide» in '3 Henry VI.,' an old play in which Greene is supposed to have had a share and which was revised by Shakespeare. In December 1592, Henry Chettle, who had published Greene's pamphlet for him, brought out his own 'Kind Harts Dreame,' in which he apologizes for Greene's sneer at Shakespeare and adds: «Myselfe have seene his demeanor no less civill than he exelent in the qualitie [of actor] he professes; besides, divers of worship [people of rank] have reported his uprightness of dealing, which argues his honesty, and his facetious [felicitous] grace in writing, that approves his art.» It is clear from Greene's envy and Chettle's eulogy that, in 1592, Shakespeare had already won credit, not only by his acting, but also by revising old plays for reproduction on the stage.

Little is known of the poet's personal history from this time until 1600. In 1596 his son Hamnet died, and was buried (11 August) at Stratford. Early in 1597 he bought New Place, a mansion with an acre of land in the best part of Stratford, and later added other lands to the estate. In 1596 John Shakespeare, doubtless by his son's advice, made application to the College of Heralds for a coat-of-arms; but the negotiations not being concluded at that time, they were renewed in 1599, when the petition was granted.

John had asked that he and his son might be allowed to quarter on the coat the arms of the Ardens of Wilmecote, his wife's family; but the heralds substituted the arms of the Ardens of Alvanley in Cheshire, apparently because those belonged to a younger branch of the family, from which Mary Arden was descended.

Shakespeare repaired New Place, which was in a dilapidated condition when he bought it. We find evidence also that he assisted in restoring the fortunes of his father, and attempted to regain certain real estate belonging to his mother which had been forfeited through complications due to a mortgage.

The earliest definite notice of Shakespeare's appearance on the stage is of his having been a player in two comedies acted before Elizabeth at Greenwich Palace in December 1594. According to the official records «William Kempe, William Shakespeare, and Richard Burbage» then received £13 6*s.* 8*d.* as payment, with £6 13*s.* 4*d.* in addition «by waye of her Majesties rewarde»— that is, as a perquisite.

Other performances before Elizabeth were in 1596, twice during the Christmas holidays, at Whitehall; at Richmond Palace on Twelfth Night and Shrove Tuesday, 1600; and at Whitehall 26 December the same year. At Christmas time, 1601–2, the company played four times at Whitehall; and at Richmond, 2 Feb. 1603 — the last occasion on which they could have appeared before Elizabeth, as she died 24 March 1603.

Shakespeare's income from acting was much greater than from authorship. From the former source before 1599 it was probably £100 a year, to which the perquisites from performances at court might add £15 or more. During the same period the prices for a play ranged from £6 to £15. His receipts from revising and writing plays up to 1599 probably did not exceed £20 a year, making his entire income about £135, equal to from seven to ten times as much in modern money. From the quarto editions of his plays, all of which were piratical, he received nothing; but from the editions of his poems — the only works printed under his own control — he may have got something, but we have no means of estimating the amount.

When the Burbages built the Globe Theatre in 1599, they leased shares in it for 25 years to «those deserving men, Shakespeare, Hemings, Condell, Phillips, and others,» all of whom were players in Shakespeare's company. There were 16 shares in all, of which Shakespeare probably had two. The annual receipts of the theatre are supposed to have been about £8,000. The yearly income of a share in 1635 is known to have been more than £200. In 1600–10 it may not have been so large, but Shakespeare must have received from the theatre, as an actor and a shareholder, at least £500 a year. From 1599 the prices of plays averaged £20 or more, and performances at court were more frequent and doubtless better paid.

In 1602 Shakespeare bought 107 acres of land near Stratford for £320, and the same year he bought a cottage and garden near New

Digitized by Google

Place. These investments, and his dealings in agricultural produce of which we have documentary evidence, were additional sources of income.

According to Rowe, the poet once received a gift of £1,000 from his generous patron, the Earl of Southampton. There can be little doubt that the amount is exaggerated, but the Earl, who is known to have been so liberal to others, can hardly have omitted to make some substantial acknowledgment of the tribute paid him in the dedications of 'Venus and Adonis' and 'Lucrece.'

In May 1602, almost immediately after he came to the throne, King James granted a license to Shakespeare and his company to play in London and the provinces. They performed not infrequently afterward at court, as the records show; and on 15 March 1604, when James made his formal passage from the Tower to Westminster, Shakespeare and the eight other actors to whom the royal license had been granted in 1603, marched in the royal train, and each was presented with four and a half yards of scarlet cloth, the usual dress-allowance of actors belonging to the royal household.

We have little positive information of the parts played by Shakespeare himself. It is reported that he took that of Adam in 'As You Like It,' and, according to Rowe, he acted "the Ghost in his own 'Hamlet.'" John Davies of Hereford (1610) says that he "played some kingly parts in sport." His name heads the list of those who took part in the first performance of Ben Jonson's 'Every Man in His Humour,' in 1598. In the list of "the principall actors in all these playes" prefixed to the Folio of 1623, his name is also placed first, but perhaps only because he was the author of the plays. There is no evidence that he ever gained high rank as an actor.

In July 1605 Shakespeare paid £440 for the unexpired term (31 years) of the moiety of a lease of the tithes of Stratford, Old Stratford, Bishopton, and Welcombe. It appears to have been a good investment, for his son-in-law, Dr. John Hall, in August 1624, disposed of his interest in the remainder of the lease for £400, or only £40 less than it cost Shakespeare nineteen years before. The lease had now only twelve years to run, but the officers of the Stratford Corporation who bought it appear to have regarded it as a judicious investment at £400.

On 5 June 1607 the poet's elder daughter Susanna, then 24 years of age, was married to Dr. John Hall, a physician who had a large practice among the good people of Stratford and the adjacent country. He was several times called to attend the Earl and Countess of Northampton, at Ludlow Castle, more than 40 miles off. His medical case-book, written in Latin, was translated and published in London (1657) after his death, and was reprinted in 1679 and 1683. Though an earnest Puritan, he was none the less popular with those who were bitterly opposed to the sect.

Shakespeare's brother Edmund died in London, in December 1607, and was buried in Saint Saviour's Church, Southwark. He is described in the parish register as "a player," and had probably come to London and entered the Globe Theatre through his brother's influence, but no notice of him as an actor has been discovered.

Elizabeth, the only child of the Halls, was baptized 21 Feb. 1608. The poet thus became a grandfather about two months before he was 44. She was married in 1626 to Thomas Nash, a citizen of Stratford, who died in 1647. Two years later she married Sir John Barnard of Abington Manor, near Northampton. She had no children by either husband. The last of the poet's lineal descendants, she was buried at Abington 17 Feb. 1669, but no monument marks her grave. In September 1608, Shakespeare's mother died, her burial being recorded on the 9th of the month. Her husband, John Shakespeare, had died seven years earlier, the record of his burial being dated 8 Sept. 1601. He left no will, and his son William inherited the Henley Street birthplace. Shakespeare's brother Gilbert (baptized 16 Oct. 1566) was buried 3 Feb. 1612, the record, by a clerical error, calling him "adolescens," though he was 45 years old. In February 1613, Richard, his last surviving brother (baptized 11 March 1574), also died. Joan (baptized 11 April 1569) was the only child of John and Mary Shakespeare now remaining. She married William Hart, who died in April 1616, his burial taking place on the 17th, eight days before that of the poet. Joan outlived her husband and brother 30 years.

In 1610 Shakespeare bought 20 acres of pasture land, adding them to the 107 acres acquired in 1602; and in March 1613 he made what appears to have been his last investment in real estate by the purchase of a house in London, near the Blackfriars Theatre. He paid £140 for it, and soon leased it to one John Robinson, who had been one of the opponents to the establishment of the theatre.

It was probably as early as 1611 that Shakespeare returned to Stratford and took up his residence at New Place. In that year his name appears on a list of Stratford citizens who were raising money to promote a Parliament bill "for the better repair of highways." In the spring of 1614 a Puritan preacher, invited to the town by the corporation, was hospitably entertained at New Place, perhaps through the influence of Dr. Hall, who may have been living with his father-in-law at the time. In the town records we read: "For one quart of sack and one quart of claret wine given to a preacher at the New Place, xx. *d.*"

In the autumn of 1614 an attempt was made by William Combe, the squire of Welcombe, to enclose a considerable area of the common fields near the town. The project was opposed by the corporation as detrimental to the agricultural interests of the town and tending to diminish the tithes. Shakespeare, as we have seen, was interested in the tithes, but it would appear that he was finally led to favor the scheme by Combe, who guaranteed that he should suffer no pecuniary loss. There is no evidence, however, that he took any active part in promoting the enclosures, which were ultimately thwarted by legal injunction in March 1615.

In February 1616, Judith, the poet's younger daughter, was married to Thomas Quiney, who was nearly four years her junior. He was then in business as a vintner, and patronized by the corporation. In 1617 he was elected

Digitized by Google

a burgess, and from 1621 to 1623 held the office of chamberlain. Later his business was less prosperous, and in 1652 he removed to London, where he died a few years afterward. He had three sons, two of whom died in infancy and the third at the age of 20. Judith Quiney lived to be 76, surviving all her family except her aunt, Joan Hart, and her niece, Elizabeth Barnard.

Shakespeare's health seems to have been failing at the time of Judith's marriage. He had made his will in the latter part of January 1616, as erasures in the document indicate; but for some reason it was not engrossed and signed at that time. In April the condition of the poet seems to have become suddenly worse, and the rough draft of the will, after a few alterations and interlineations, was signed without waiting for a clean transcript of it.

There is no mention of his wife in the will except the interlined bequest of the «second best bed with the furniture»; but she was amply provided for by her rights of dower, and such omission in a case of the kind is not uncommon in wills of the time. The gift of the bed, like many similar bequests in these old wills, was doubtless prompted by love and tender associations, not the insult of a dying man to the mother of his children. The misinterpretation of this clause in the will is absolutely the sole ground for the supposition that the poet was unhappy in his conjugal relations, while there is the strongest circumstantial evidence to the contrary. We have seen that, more than 20 years earlier in London, he was planning for his return to a residence in his native town. In 1597 he was able to buy the best house in Stratford, and he gradually developed and improved the estate, making it an ideal home for his declining years — but not, we may be certain, to be shared with a wife from whom he was estranged. His widow survived him almost seven years (her burial was on 8 Feb. 1623) and tradition says that she earnestly desired to be laid in the same grave with her husband.

The funeral of «Will Shakespeare, gent.,» as the parish register informs us, occurred 25 April 1616. His grave is in the chancel of the parish church, the legal place for the interment of the owners of the tithes. It is covered with a stone bearing the inscription:

Good frend, for Jesus sake forbeare
To digg the dust encloased heare;
Bleste be the man that spares thes stones,
And curst be he that moves my bones.

It was not until about 70 years after his death that these lines were ascribed to Shakespeare. Neither Dugdale, in 1656, nor Rowe, in 1709, when referring to the tomb, attribute them to him. If he desired that something to the same effect should be put upon the stone, it was doubtless from fear that his bones might some day be removed to the ancient charnel house that then adjoined the church but was afterward demolished.

The monument to the poet on the chancel wall was erected before 1623. The life-sized bust is supposed to have been copied from a posthumous cast of his face. It is poor as a work of art, but it must have been accepted by his surviving relatives as a tolerably good portrait. It bears a general resemblance to the only other portrait the authenticity of which is established,— the engraving in the Folio of 1623, the execution of which is equally bad. A painted portrait in the Shakespeare Memorial Gallery at Stratford is believed by many to be the original of that engraving, but others think it was copied from the engraving. The so-called Ely House portrait, according to some critics, was the basis of the engraving. There are many other alleged portraits, but their history is more or less doubtful.

The order in which Shakespeare's works were written has been the subject of much discussion and dispute, but is now approximately settled. If he wrote the repulsive tragedy of 'Titus Andronicus,' it was probably as early as 1590; but the critics generally agree that it was an old play slightly retouched by him about that time. The three parts of 'Henry VI.' are quite certainly other plays upon which he worked in the same way during his dramatic apprenticeship, the second and third parts having a considerably larger share of his work than the first part. When he attempted wholly original work, it was in comedy, and 'Love's Labour's Lost' was the play. The first version must have been written as early as 1591, the present one, printed in 1598, having been, as the title-page states, «newly revised and augmented.» 'The Two Gentlemen of Verona' and 'The Comedy of Errors' soon followed, together with the first draft of 'Romeo and Juliet,' which was afterward revised and enlarged. 'Richard III.,' which naturally follows the trilogy of 'Henry VI.,' appears, on the whole, to be entirely Shakespeare's, and was probably written in 1592 or 1593, and 'Richard II.' soon afterward, though the earliest extant editions of both plays date only from 1597. 'A Midsummer Night's Dream' belongs in the group of early comedies, but was the last of the series, being generally ascribed to 1594.

'Venus and Adonis' appeared in 1593, and the poet, in the dedication to the Earl of Southampton, calls it «the first heir of my invention,» or imagination; but this seems to mean that it was his first *literary* production, plays in that day not being regarded as literature properly so called. The poem was published in 1593, and ran through at least 12 editions in the next 16 years. 'Lucrece,' also dedicated to Southampton, was published in 1594, and was almost as popular, eight editions being extant.

During the next six years (1595–1600) the poet completed the series of English historical plays (except 'Henry VIII.'), the order apparently being: 'King John' (1595), 1 and 2 'Henry IV.' (1596, 1597), and 'Henry V.' (1598). 'The Merry Wives of Windsor,' said to have been written at the request of Elizabeth, probably came between '2 Henry IV.' and 'Henry V.' 'The Merchant of Venice,' written in 1596 or 1597, together with all the plays mentioned above, except 'Henry VI.,' is included in a list of Shakespeare's dramas in Francis Meres's 'Palladis Tamia,' published in September 1598. 'The Taming of the Shrew' (based upon the anonymous 'Taming of a Shrew,' printed in 1594), though not mentioned by Meres, was probably produced in 1597, at the latest. Meres ascribes to Shakespeare a play entitled 'Love's Labour's Won.' which may

Digitized by Google

be the 'Taming of the Shrew,' though many critics believe it to be an early form of 'All's Well that Ends Well.'

Between 1598 and 1600 the three brilliant comedies, 'As You Like It,' 'Much Ado About Nothing,' and 'Twelfth Night' were written, but in what order is uncertain. 'Julius Cæsar' belongs to the same period. These plays were followed by 'All's Well that Ends Well,' 'Measure for Measure,' and 'Troilus and Cressida,' the dates of all which are more or less doubtful; but these plays, which are comedies only in not having a tragic ending, seem to form a natural group, leading up to the period of the great tragedies, if not partly belonging to it. 'Hamlet' introduces the latter group, the earliest quarto edition having been printed in 1603. It was followed in 1604 by a second quarto, described as "newly imprinted and enlarged to almost as much again as it was." 'Othello' was probably a new play when it was performed before King James in November 1604. 'Macbeth' is generally dated in 1606 or 1607, and 'King Lear' was produced at about the same time. 'Antony and Cleopatra' and 'Coriolanus' are supposed to have been written in 1607 or 1608.

The tragedies were followed by a group of three plays which have been aptly called "Romances": 'Cymbeline,' 'The Winter's Tale,' and 'The Tempest'; all written in 1609-11, and not improbably in the order mentioned. Campbell, the poet, believed that 'The Tempest' was the last of the plays, James Russell Lowell expressed the same opinion, and many critics agree with them, but some think that 'The Winter's Tale' was the later work.

Besides the plays of mixed or doubtful authorship belonging to Shakespeare's earliest period and 'The Taming of the Shrew,' there are several others of later date which appear to have a similar history: 'Timon of Athens,' 'Pericles,' and 'Henry VIII.' Shakespeare's share in all of them is indisputable, but the critics disagree in explaining the divided authorship. The most plausible theory is that all three were begun by Shakespeare, but for some unknown reason were laid aside or left unfinished, and afterward completed by others. In the case of 'Timon' it is neither known nor suspected who the other author was. In 'Pericles' it was undoubtedly George Wilkins, who in 1608 (a year after the play was first printed) published a novel avowedly based upon it. The first two acts of the play appear to be his, but some believe that the later prose scenes and the Gower prologues are by a third hand. Large portions of 'Henry VIII.' are evidently by John Fletcher, some of whose metrical peculiarities are unmistakable. The rest has been ascribed by one or two critics to Massinger, but there can be little doubt that it is Shakespeare's.

'The Two Noble Kinsmen' is another play which some excellent critics believe to be partly Shakespeare's. The title-page of the earliest edition (1634) ascribes it to "the memorable Worthies of their time: Mr. John Fletcher and Mr. William Shakespeare." Fletcher's hand in it is obvious, but it is uncertain who was the other author. The anonymous play of 'Edward III.' is ascribed to Shakespeare by certain German critics, and some in England believe that portions of it are his, but it is extremely improbable that he wrote a line of it. Sundry other plays were ascribed to him in his lifetime or afterward, but without authority or warrant.

The 'Sonnets' of Shakespeare were first published in 1609, but Meres in 1598 refers to his "sugred sonnets among his private friends," and two of them were printed in 'The Passionate Pilgrim,' a piratical collection of verse, in 1599. It is probable that the majority of them were written between 1597 and 1601, but some may be of later date. 'A Lover's Complaint,' printed with the 'Sonnets' in 1609, is undoubtedly Shakespeare's. It is in the same stanza as 'Lucrece,' and internal evidence indicates that it was somewhat later than that poem. 'The Phœnix and the Turtle' must have been written before 1601, when it was printed as Shakespeare's in a volume with Chester's 'Love's Martyr' and poems by Marston, Chapman, Ben Jonson, and others. In 'The Passionate Pilgrim,' besides the two sonnets mentioned above and two lyrics from 'Love's Labour's Lost,' several other poems are attributed to Shakespeare and printed in the modern editions of his works, but some of them are known to belong to other authors, and it is very doubtful whether any of the rest are his.

No collected edition of Shakespeare's plays appeared until seven years after his death, when the "first folio," or the "folio of 1623," was published. It was nominally edited by two of his friends and fellow-actors, John Heming (or Hemings) and Henry Condell, and contained 36 of the plays included in modern editions, 'Pericles' being omitted. Sixteen of the plays had been already published in quarto form, the other 20 were printed for the first time. The book evidently had no editing worthy of the name. Heming and Condell did little except to furnish the publishers with the best copies of the plays they could get; and these were partly manuscripts and partly early quartos, all of which had been used in the theatre by the actors in learning their parts. This is evident from the fact that in many instances names of actors are inserted at the beginning of speeches and in stage-directions instead of those of the *dramatis personæ*. Every conceivable form of typographical corruption and perversion abounds. It is estimated that at least 20,000 "readings" occur that are clearly wrong or highly suspicious, to say nothing of a far greater number of minor misprints and mispointings. Verse is often printed as prose, and prose as verse. Stage-directions and text are often confounded. Words and phrases from foreign languages are almost invariably corrupted, sometimes to such a degree that critics cannot decide whether they are Latin, French, or Spanish. Some plays are divided into acts and scenes, some only into acts, some not at all, and the division is often confused or inaccurate. In face of all these facts the Baconian heretics claim that the folio was edited by Bacon, the plays being carefully revised, corrected, and printed when he had abundant leisure for seeing them through the press.

The second folio (1632) was a reprint of the first, with few changes for the better and some for the worse. The third appeared in 1663, and was reprinted in 1664, with the addi-

Digitized by Google

tion of 'Pericles' and six plays falsely ascribed to Shakespeare. The fourth folio (1685) was a reprint of that of 1664, with no material change except that the spelling was somewhat modernized.

No other collected edition appeared until 1709, when Rowe's, based on the fourth folio, was published. The poems were first included in the second edition (1714). Of the other complete editions in the 18th century and the early part of the 19th, the most important were Pope's (1723-5), Theobald's (1733), Hanmer's (1744), Warburton's (1747), Johnson's (1765), Capell's (1768), Steevens's revision of Johnson's (1773), Malone's (1790), Steevens', with Boydell's illustrations (1791-1802), Reed's (1803), Chalmers' (1805), and the 'Variorum' of 1821, edited by James Boswell from a corrected proof left by Malone. Some of these were reprinted more than once.

Since 1821 editions, commentaries, and critical and illustrative works on Shakespeare have so enormously multiplied that a list of them, even in the most concise form, cannot be added here. For the bibliography of the subject the reader may be referred to Lowndes's 'Library Manual' (Bohn's ed.); Franz Thimm's 'Shakespeariana' (1864 and 1871); the 'Encyclopædia Britannica' (9th ed.); and the 'Shakespeariana' (3,680 titles) of the 'British Museum Catalogue' (published separately in 1897).

The first complete American edition of Shakespeare (with life, glossary, and notes by Dr. Johnson) was published in 8 vols. in 1795-6, at Philadelphia. The first Boston edition (including only the plays) was in eight volumes (1802-4). Three editions of this appeared, each reset, stereotyping being then unknown. An edition of 17 volumes was brought out in Philadelphia in 1809, and one in seven volumes (edited by O. W. B. Peabody, though his name does not appear in it) in Boston in 1836. Reprints of Reed's text had been issued there in 1813 and 1814. An edition of the plays in 10 volumes (Reed's text), was published in New York in 1821, and again in 1824. The first critical, thoroughly annotated, and illustrated American edition was G. C. Verplanck's (3 vols., New York 1844-7). Of more recent editions the only one that can be mentioned here is Horace Howard Furness's 'New Variorum' (the first since 1821, and on a far larger scale), of which 12 volumes have now (1904) been published. This country has also produced the first Concordance to the 'Poems' (Mrs. H. H. Furness's, 1874) and the best Concordance to the Complete Works (John Bartlett's, 1895). The first critical work on the plays from a *feminine* pen was 'Shakespeare Illustrated' (3 vols., London 1753-4), by Mrs. Charlotte Lennox (1720-1804), who was born in New York, where her father, Col. James Ramsay, was lieutenant-governor. From the age of 15 she lived in England. The dedication of this work to the Earl of Orrery was written by Dr. Johnson.

William J. Rolfe,
Author of 'Life of Shakespeare.

Shakespeare, Authorship of. In the history of controversy over the authorship or the authenticity of writings two debates during the last hundred years have risen into special prominence — that relating to the Homeric poems and that which concerns the works commonly attributed to William Shakespeare. F. A. Wolf (q.v.), in his 'Prolegomena ad Homerum' (1795), essayed to demonstrate that the Homeric poems were not the work of any one man, but a compilation of rhapsodies composed by different minstrels and sung in the public assemblies while yet the art of writing was little known. Before this formidable attack upon the Homeric authorship there had been wide disagreement among critics upon various questions regarding the poems, including the probable date of their composition. Obscurities in respect to these matters are referred mainly to the lack of biographical materials relating to Homer himself. In this particular the case of Shakespeare is involved in almost equal difficulty, although it is not yet 300 years since the reputed dramatist's death. To many it seems scarcely less wonderful that the man who wrote the plays and poems known as Shakespeare's could have remained so far hidden from the world, despite its eager search for him, than that those writings should be the production of a person so obscure. When Hume declared miracles impossible because improbable, Whately, by a mock chronicle, reduced Napoleon to nonentity. But the non-existence of Shakespeare is not asserted in the controversy. They who dispute his authorship base their denial mainly upon antecedent improbability, as Hume did his argument against miracles. Indeed one conspicuous champion of Shakespeare asks: «Why is it not the simplest plan to let Shakespeare stand as a simple miracle?» regarding him as «a much simpler miracle than he would be if any of the current explanations of him were accepted.» Critical inquiry, however, still seeks and will seek a cause equal to the effect, a man or men adequate to the result to be accounted for.

Although this authorship controversy, in various phases, had earlier beginnings, it assumed its most definite character about the middle of the 19th century, since when, as Brandes complains, the great name of Shakespeare has been «besmirched by American and European imbecility.» «A troop of less than half-educated people,» he declares, «have put forth the doctrine that Shakespeare lent his name to a body of poetry with which he had really nothing to do — which he could not have understood, much less have written.» Brandes ('William Shakespeare' 1899) cites W. H. Wyman's 'Bibliography of the Bacon-Shakespeare Controversy' (1884), showing that «there had been published up to that date 255 books, pamphlets, and essays as to the authorship of Shakespeare's plays. In America 161 treatises of considerable bulk had been devoted to the question, and in England 69. Of these, 73 were decidedly opposed to Shakespeare's authorship, while 65 left the question undetermined. In other words, out of 161 books, only 23 were in favor of Shakespeare. And since then the proportion has no doubt remained much the same.»

The anti-Shakespearian view consists of two main theories, that of a composite or a «syndicate» authorship, and that of a single authorship. If the latter be regarded as involving almost a miracle, the other, it has been declared, suggests a combination of miracles. If there was great collaboration there must have been also one master genius whose primacy reduced all partnership to practical insignificance. Yet that

Digitized by Google

there was partnership is evident from the discoveries of critics who show where different hands have set their marks in the plays and poems called Shakespeare's.

The view of single authorship, other than Shakespeare's, as mainly held, is known as the Baconian theory. The earliest recorded surmise that the real author of the Shakespearian writings was Francis Bacon appears to have been that of «a Mr. William Smith,» in a privately-printed letter to Lord Ellesmere (1856), basing his opinion on Shakespeare's obvious incapability of producing the works attributed to him, and on the manifold qualifications of Bacon. About the same time Delia Salter Bacon, an American woman, gave a more considerable form to this theory («delusion,» Brandes calls it) in a number of magazine articles, succeeded by a volume, 'The Philosophy of the Plays of Shakespeare Unfolded' (1857), in which she set forth the deficiencies of the «Stratford butcher-boy» and «poacher» in contrast to the attainments of Bacon, to whom she assigned the principal part in the authorship of the plays. She was followed by Nathaniel Holmes, an American jurist and a writer of much literary skill, in a work, 'The Authorship of Shakespeare' (1866, 1886), vigorously supporting the Baconian theory, and giving increased importance to the discussion. Meanwhile a new phase of the subject began to appear in alleged discoveries of a cipher in the plays embodying a confession of his authorship by Bacon himself. This line of investigation was followed by Ignatius Donnelly, an American lawyer and politician, in what Brandes calls «his crazy book,» 'The Great Cryptogram: Francis Bacon's Cipher in the so called Shakespeare Plays' (1st part 1888). This inquiry was further pursued by Donnelly up to his death, and has been continued by others; notably, in America, by O. W. Owen of Detroit, Isaac Hull Platt of New York, and the late R. M. Bucke of London, Ont. For an exposition of Bacon's anagram, which Platt claims to have discovered in the plays, as well as of Bucke's views, consult the latter's 'Cosmic Consciousness' (1901), «Francis Bacon.» Apart from the cipher theory, the general reliance of the Baconians is upon points summed up by John Weiss, a reasonable defender of the traditional authorship, in 'Wit, Humor, and Shakspeare' (1876), as follows: «The plays are too great, and out of all proportion to the obscurity which rests upon Shakespeare's life, and to the insignificance of his contemporary fame. They are filled with all kinds of classical allusion, professional information, legal, medical, horticultural, scientific, to an extent which an obscure play-actor could not possibly comprise within the limits of his ragged and scanty education. The plays contain remarkable parallelisms with passages in Bacon's works, and coincidences of thought and expression.» This is perhaps as fair a summary as could be made in so few words; but the Baconians multiply instances and arguments with great extension and cumulative force, finding in Bacon's 'Promus' especially, but also in many places throughout his writings, words and passages which they cite in proof.

Among suggesters and advocates of the «syndicate» theory is Appleton Morgan of New York, who in his work 'The Shakespearean Myth' (1880), advanced the view that the plays were jointly produced by at least two men, one a poet and dramatist, the other a business man connected with a theatre: and in later writings this author has amplified this conjecture, which has also been elaborated by «A Cambridge Graduate» in a volume entitled 'Is It Shakespeare?' (1903). It is likewise set forth by William H. Edwards in 'Shaksper not Shakespeare' (1900). «It is enough for me,» he says, «to prove that William Shaksper did not write these plays. Who did, I know not, and offer no suggestions; but when the venerable Shakespeare image has tumbled, and the critics have a little time to clear their eyes of dust and cobwebs, the real authors may be discovered — authors, for I believe there were several associates who wrote under the assumed name of 'William Shakespeare.' »

Toward all this anti-Shakespearian argument the general attitude of writers on the other side has been that of ridicule and contempt. The persistence of the unorthodox, however, has compelled, in the interest of the Shakespeare cause, as well as in that of free scholarship and fair investigation, a more serious attention on the part of those who would uphold the traditional view. The burden of proof thus far is on the unorthodox, and of necessity their proofs hitherto are chiefly negative. But so too are the arguments of their opponents, who, at least with respect to Bacon, can do little more than set one great improbability against another, adducing also whatever they can of a positive nature from scanty documentary sources, the witness of Shakespeare's contemporaries, oral tradition, and the like. The consensus of Shakespearians on the conservative side finds in these evidences probabilities at least in which they are content to rest until overcome by resistless demonstration. To the Baconians their answer is perhaps sufficiently conveyed in the conclusion of Sidney Lee in his 'Life of William Shakespeare' (1898): «The abundance of contemporary evidence attesting Shakespeare's responsibility for the works published under his name gives the Baconian theory no rational right to a hearing; while such authentic examples of Bacon's effort to write verse as survive prove beyond all possibility of contradiction that, great as he was as a prose-writer and a philosopher, he was incapable of penning any of the poetry assigned to Shakespeare.» And yet, in view of all that has followed from the work of Delia Bacon, it seems proper to repeat Emerson's remark, that she opened this question «so that it can never again be closed,» at least until positive proofs on one side or the other shall be produced. Meanwhile a liberal spirit of investigation can hardly deprecate the controversy which has already thrown so many side lights upon the Shakespearian literature and tradition. Besides the above works cited, of which Wyman's 'Bibliography' is especially important as a source of reference, a few of the more recent writings on the subject may be mentioned. Consult: White, 'Studies in Shakespeare' (1886); Stopes, 'The Bacon-Shakespeare Question Answered' (1889); Owen, 'Sir Francis Bacon's Cipher Story Discovered and Deciphered' (1893-4); Reed, 'Bacon *vs.* Shakespeare: a Brief for the Plaintiff' (7th ed. 1897); 'Bacon and Shake-speare Parallelisms' (1902); 'Francis Bacon Our Shake-speare' (1902);

Digitized by Google

Allen, 'Notes on the Bacon-Shakespeare Question' (1900); Bayley, 'The Tragedy of Sir Francis Bacon: an Appeal for further Investigation and Research' (1902); Crawford, 'The Bacon-Shakespeare Question,' in 'Notes and Queries,' series 9, Vols IX.–XI. (1902–3); Gallup, 'The Bi-literal Cypher of Sir Francis Bacon' (1902); Mallock, 'Last Words on Mrs. Gallup's Alleged Cypher,' in 'Nineteenth Century and After,' Vol. LIV., pp. 55–71 (1902); 'A New Light on the Bacon-Shakespeare Cypher' (1902); 'New Facts relating to the Bacon-Shakespeare Question,' in the 'Pall Mall Magazine,' Vol. XXIX., pp. 77–89; 215–228 (1903); Lang, 'Mrs. Gallup and Francis Bacon,' in 'Monthly Review,' Vol. II., pp. 146–162 (1902); Webb, 'The Mystery of William Shakespeare: a Summary of Evidence' (1902); Boubée, 'Shakespeare ou Bacon?' (1903); the various writings on the subject by Edwin Bormann, published in Leipsic (1895–1903); and the publications of the Bacon Society.

JOHN H. CLIFFORD,
Editorial Staff, 'Encyclopedia Americana.'

Shakespeare Societies. The first Shakespeare society was founded in 1841, in London, and before its dissolution in 1853, had published 48 volumes. A new English Shakespeare society was organized in 1874, and the German Shakespeare Society was founded at Weimar in 1864. In the United States the Shakespeare Society of New York was organized in 1885.

Shak'tas. See RELIGIOUS SECTS.

Shale, a sedimentary rock of the variety designated a lutyte, that is, a rock made up of finely pulverized rock flour with a large though variable admixture of clay, and splitting into thin layers parallel to the bedding plane. In the typical shales the rock splits with a conchoidal or shelly fracture, the surface being marked by wide shallow depressions rather than by absolute smoothness. In composition, shales may be purely argillaceous (argillutytes), but they are generally more or less silicious, calcareous, ferruginous or carbonaceous, according to the material admixed with the clay. The carbonaceous shales are often used for the manufacture of oil or gas, some of them being so rich in carbon as to burn with a bright flame. Alum shales are clay shales rich in iron pyrites which on decomposing permits the formation of sulphuric acid, which in turn reacts upon the clay shale. The reactions are approximately as follows:

(*a*) $2FeS_2 + 7O_2 + 2H_2O = 2FeSO_4 + 2H_2SO_4$
(*b*) $6H_2SO_4 + Al_2 (SiO_3)_3Al_2O_6H_4$ (Shale) $= 2Al_2(SiO_4)_3 + 3SiO_2 + 8H_2O$.

The aluminum sulphate will often crystallize in dry places on the shale surfaces, forming an efflorescence. The sulphate of iron formed will stain the surfaces of the shale a rusty brown. Shales are often ground up and artificially disintegrated, to form clay for various purposes in the arts.

Shaler, Alexander, American soldier: b. Haddam, Conn., 19 March 1827. He was educated in private schools and graduated from Brainard Academy in 1844. In 1845 he joined the Washington Grays (later known as 8th regiment New York State militia) and transferred to the 7th regiment in 1848, becoming major of that regiment in 1860. He was commissioned lieutenant-colonel of the 65th New York Volunteers on the outbreak of the Civil War, and became colonel in 1862, commanding the military prison at Johnson's Island, Ohio, during the winter of 1863–4. He served with the Army of the Potomac, participating in all its battles, until 6 May 1864, when he was taken prisoner at the battle of the Wilderness, and was held in Charleston, S. C., during the summer of that year. After his exchange he commanded a division in the 7th corps and the post of Duval's Bluffs, Ark., serving in the Southwest until he was mustered out 24 Aug. 1865. He was commissioned brigadier-general of volunteers in 1863, and brevetted major-general of volunteers in 1865. From 1867 until 1870 he was president of the board of commissioners of the Metropolitan fire department, and commissioner of the fire department of New York 1870–3. He was consulting engineer to the Chicago board of police and fire in 1874–5, being charged with the reorganization and instruction of the fire department of that city. From 1867 till 1886 he was major-general of the 1st division of the National Guard of the State of New York, and was an organizer and president of the National Rifle Association of the United States. While a member of the board for the purchase of sites for armories he was accused of bribery, but although he was tried twice the jury disagreed each time. Gen. Shaler published a 'Manual of Arms for Light Infantry Using the Rifle Musket' (1861).

Shaler, shā'lėr, **Nathaniel Southgate,** American geologist: b. Newport, Ky., 20 Feb. 1841; d. Cambridge, Mass., 10 April 1906. He was graduated from the Lawrence Scientific School, Harvard, in 1862, served in the Union army as an artillery officer, and then returned to the Lawrence School, where he was assistant and instructor in geology and zoology. He accepted the chair of palæontology at Harvard in 1868, was transferred in 1887 to that of geology, and he was dean of the Lawrence School from 1891. In 1873–80 he was in charge of the Kentucky geological survey, and from 1884 was director of the Atlantic division of the United States geological survey. He was commissioner of agriculture for the State of Massachusetts at different times, was president of the Geological Society of America in 1895, and besides numerous reports for the United States geological survey published: 'Kentucky Geological Reports and Memoirs' (7 vols. 1876–82); 'The Story of Our Continent' (1892); 'The Interpretation of Nature' (1893); 'The United States of America' (2 vols., 1894); 'The Individual: Study of Life and Death' (1900); 'The Citizen: A Study of the Individual and the Government' (1904); etc.

Shalloon', a light woolen textile said to derive its name from Châlons in France, where it was originally manufactured.

Shal'lop, a light fishing-vessel with two masts and carrying lug or fore-and-aft sails; also a small boat for one or two oarsmen.

Shal'lot, or **Eschallot,** a perennial bulbous plant (*Allium ascalonicum*) of the order *Liliaceæ*. The bulbs are seldom two inches long

Digitized by Google

and an inch in diameter. They send up hollow small leaves which are often used for mixing with salads and dressings, or are eaten alone. The bulbs are also similarly used. They are planted in early spring in rich soil about four inches asunder, in rows 15 to 18 inches apart, and kept cleanly cultivated throughout the season. The leaves may be cut at any time and the bulbs taken up in autumn, dried like onions or garlic, and kept in a dry, cool place. From two to six bulbs are usually produced by each bulb planted. In the South they are generally planted in autumn and even in the North they may be left in the ground over winter. They are less grown in the United States than in Europe.

Shalmaneser, shăl-ma-nē'zėr, second of his name, the Assyrian king, who in 853 B.C. defeated Benhadad with his ally, Ahab, king of Israel, at Karkar, the Biblical Kir-haraseth (2 Kings iii. 25), on the Orontes. See AHAB; ASSYRIA.

Sha'manism, the primitive religion of the Mongol tribes, resembling in its general features the superstitions of uncivilized American Indians, and other savage races. Shamanism cannot be called a religion in the sense of a creed or belief with recognized and fundamental principles. It is rather the outward expression of the imaginations and terrors of an ignorant savage regarding the supernatural, and its practices mainly consist in enchantments and other delusions, accompanied by pretended possession by spirits, and the various similar deceptions through which the shaman, like the African sorcerer, and the Indian medicine-man, exerts control over his dupes. There is belief in a future existence, but without any definite idea as to conditions after death. Shamanism still lingers among the less advanced Mongol tribes, and has left its impression even where it has been superseded by the doctrines of Confucius and Zoroaster, and of the Buddhists.

Shamokin, sha-mō'kĭn, Pa., borough in Northumberland County; on the Philadelphia & R. and Pennsylvania R.R.'s; about 45 miles north by east of Harrisburg, the capital of the State. It was settled in 1835 by people employed in developing the coal mines. It was incorporated as a borough in 1864. It is the industrial and commercial centre of a region rich in anthracite coal. The chief industrial establishments are foundries, machine shops, knitting and planing mills, and flour mills; and a large number of the inhabitants of the borough are employed in the mines in the vicinity. The borough has an extensive trade in coal and in iron products, and in knit goods. There are 18 churches, two free high schools, one under the auspices of Saint Edward's Church, seven public and three parish schools, and a public library. The four banks, two national and two state, have a combined capital of $375,000. The government is vested in a chief burgess and a council of 20 members, 10 of whom are elected annually. The majority of the inhabitants are native born, but there are a number from Wales, Poland, Hungary, and Germany, also from England, Ireland, and Scotland. Pop. (1910) 19,588.

J. F. HOOVER,
Editor 'The Daily News.'

Shamrock, a name derived from the Irish *seamrog,* meaning "trefoil," and applied to various trifoliate plants native to Ireland, and even to the water-cress (which is not three-parted). Each is said to be the plant picked by Saint Patrick as a symbol to illustrate the doctrine of the Trinity. The Shamrock is worn on Saint Patrick's Day, 17th of March, and has come to be regarded as the national plant of Ireland. The black medic (*Medicago lupulina*), *Oxalis acetasella*, various clovers, such as the common red clover (*Trifolium pratense*), a trailing hop-clover, with small leaves and yellow heads (*T. minus*), and the common low, white clover (*T. repens*), are widely sold as the 'true' shamrock, and exported in large quantities to the United States and other countries, where Irishmen make a custom of wearing the sprays on Saint Patrick's day as a reminder of home associations.

Shan-hai-kwan, shăn-hī-kwăn, China, a town in the province of Chi-li, situated on the Gulf of Liao-tung, on the Manchurian boundary, and at the point where the Great Wall reaches the sea. It is a station on the Imperial Northern Railroad, and a point of great strategic importance. Being a Chinese garrison town, it was occupied during the Boxer troubles of 1901 by troops of the allied Powers.

Shan-si, shăn-sē, China, an inland northern province, bounded east by Chi-li and Ho-nan, south by Ho-nan, west by Shen-si, and north by Mongolia and the Great Wall; area, 81,830 square miles. Its rugged surface contrasts strikingly with the level tracts in some of the surrounding provinces, although the lowland parts of it are represented as being well cultivated and terraced. The rivers, which are almost all tributaries of the Hwang-ho or Yellow River, are numerous, but not large. The Fen-ho, the largest of these streams, is about 300 miles long, and falls into the Yellow River near the southwest corner of the province, after draining the central part. The north contains some of the favorite imperial hunting grounds; and the inhabitants find sources of wealth in the coal, iron, cinnabar, copper, marble, lapis-lazuli, jasper, salt, and other minerals, which it affords. The principal grains are wheat and millet, besides a great variety of vegetables, with grapes and other fruits. Besides Tai-yuan, the capital, there are several populous towns in the province. This province is the original seat of the Chinese people, and many of the events recorded in their ancient annals occurred within its borders. Pop. 12,200,500.

Shan (shăn) States, Indo-China, a series of petty states on the east of Burma, and north of Siam, occupying an area not well defined. The northern part of the Shan country comprises the North and the South Shan states, belonging to British Burma, and the southern part, the Laos or Siamese Shan states belonging to Siam. The Shans are descendants of an aboriginal race from the mountains on the western borders of China, and are closely allied to the Laos and the Siamese. They are an indolent, laughter-loving people, fond of gambling and cock-fighting, not unwarlike, though orderly and fairly trustworthy; the women have great influence, and enjoy equal freedom with the men. Slavery, however, exists, but in a

Digitized by Google

mild form; and serfdom is general. While the chief employment is agriculture, there are noted manufactures of chased work in gold and silver. The rule of the native chiefs is generally just and mild, and taxation is light. Buddhism is the dominant religion, though it is mingled with many superstitious practices. See Laos; Lolos; and Siam.

Shan-tung, shăn-toong', China, a northern maritime province bounded north and west by Chi-li, southeast by the Gulf of Pe-chi-li, and the Yellow Sea; and south by Kiang-su and Ho-nan; area, 55,970 square miles. The greater portion of this province is level, but the peninsular parts of it are hilly. The shores are generally bold, and full of indentations, some of which are excellent harbors. Wei-hai-wei leased to the British, Kiao-chau leased to Germany, and the native towns Teng-chau and Chi-fu are the only important seaport towns along the entire coast. The province is intersected by several rivers. The only large one flowing direct to the sea is the Yellow River or Hwang-ho, which, after traversing the province in a northeast direction, flows into the Gulf of Pe-chi-li. The inland navigation is augmented by the grand canal which traverses the west part of the province northwest to southeast, affording great trading advantages, and the transit trade is extensive. Drugs and vast quantities of vegetables are exported; and felt caps, carpets, and some coarse hempen cloths are manufactured. The province is over-peopled, and the great proportion of the people are poor; still they appear to be contented, and attach peculiar importance to this province, on account of its being the birthplace of Confucius and his disciple Mencius; and also because it contains the Tai-shan, or Great Mount, which forms a favorite resort of devotees from amazing distances. Its capital is Tsi-nan. Pop. 38,247,900.

Shanghai, shăng-hī', China, a seaport city, the most important of the Chinese treaty ports, one of the five opened to foreign commerce in 1843, in the province of Kiang-su, near the junction of the Hwang-pu and the Wu-sung rivers, 12 miles from the mouth of the Yang-tse-kiang, and 150 miles southeast of Nanking. Old Shanghai, or the Chinese city, is surrounded by a wall 24 feet high, pierced by six gates, and enclosing an area of about two square miles. The streets are narrow and dirty, and the buildings, low and crowded; modern sanitation, and other improvements, are being introduced gradually. The principal buildings are the Wei-Kwan, a commercial tribunal; a temple dedicated to the goddess of the seas; the Hall of Benevolence, and other charitable institutions; a medical college; and the city prison. The foreign settlement is quite distinct in its boundaries, government, and commerce. It stands on the left bank of the Hwang-pu, below the walled city from which it is separated by a moat, spanned by several bridges. Two creeks divide the settlement into three sections, the upper being the French concession; the central, the British; and the lower, the American. They are held at a low rental from the Chinese government under a code of regulations drawn up by the treaty powers.

The British section is the most valuable, and the consulates of all the other nations are situated there, except the French and American. A municipal council is elected by the foreign renters of the English and American quarters, and another by the French, whose quarter is separately administered. The subjects and citizens of each nationality are under the protection of their respective consuls, and amenable to the jurisdiction of their courts; or, where the person has no consul to appeal to, he is amenable to the Chinese authorities. Chinese in foreign employ are exempt from imperial jurisdiction. Great improvements have recently been carried out, new roads being made, larger and more substantial buildings being erected, including fine villas, etc.

Along the bank of the Hwang-pu extends a wide "bund" or quay, with a bulwark of stone and numerous stone jetties, for landing and loading cargo; while the path forms a promenade for the residents from 50 to 80 feet wide. It extends for one mile in length, and contains spacious houses surrounded with gardens; the lower stories being often used as stores (go-downs) and counting-houses, the upper as residences.

The chief mission establishments in China are at Shanghai. That of the London Missionary Society has a printing office for publishing religious works in Chinese, from which was issued in one year 500,000 copies of the New Testament for gratuitous distribution, or at a small charge. Connected with the mission is a hospital for the gratuitous care of native patients, under the charge of a medical missionary, where many thousands attend during the year. The American Presbyterian Mission not only print in Chinese, but manufacture the metallic types. There is an extensive mission, also, under the auspices of the French *Société de la Propagation de la Foi,* where the missionaries conform to the dress and manners of the Chinese, with an extensive establishment near the walled city, having a cathedral within its precincts, capable of accommodating 3,000 people. Besides this the French have a handsome church in their concession. In the British concession there is an English church, with several chapels and meeting houses scattered over the other parts of the settlement. Here also is a public library, and a branch of the Royal Asiatic Society. Cotton spinning and shipbuilding are among the chief industries of Shanghai, and there are silk filatures, flour, rice, and paper mills, furniture and piano works, etc.

The port of Shanghai extends from the upper limits of the Hwang-pu, below the native shipping, to Wu-sung, a distance of 12 miles, connected by rail, and of which the anchorage for foreign vessels extends for four miles below the settlement. The anchorage is divided into sections, defining the foreign from the Chinese boundary, where all the vessels are anchored abreast, and lettered according to their position, steamers being separated from sailing ships. A foreign harbor-master is appointed by the Chinese authorities, who retain complete control over the conservancy of the harbor and its entrance, and collect all shipping dues, duties on imports and exports, etc., through the imperial foreign maritime customs. Shanghai has water communication with about a third of

Digitized by Google

China, and its trade has become very extensive, the port being connected with a system of steamship lines which carry cargo and passengers to and from all parts of the world. The largest trade is with Great Britain and her dependencies, but Japan, the United States, Germany, and Russia are increasing their share. The gross value of foreign imports in 1901 was $110,979,464, the great bulk of which represented goods re-exported to other ports. The exports to foreign countries for the same year were valued at $56,676,400. The chief foreign imports are opium, cotton yarns and piece goods, metals, kerosene oil, coal, and sugar; and the leading exports are raw silk and silk piece goods, tea, raw cotton, hides, and native cloths. A considerable share of the coasting trade is in British hands, and both in the home and foreign trade steamers are chiefly employed. In 1900, 7,982,850 tons of foreign shipping entered and cleared the port, of which 5,043,700 tons were British; besides this the native shipping entered and cleared amounted to 1,449,560 tons. Pop. about 620,000; the foreign population is 7,000, of whom 3,000 are British.

Shanghai, a breed of fowls. See POULTRY.

Shanks, William Franklin Gore, American journalist: b. Shelbyville, Ky., 20 April, 1837; d. Hamilton, Bermuda, 22 Feb. 1905. He was a war correspondent for the New York *Herald* during the Civil War, afterward an editorial writer on that and other New York papers, and was managing editor of 'Harper's Weekly,' 1867–9. He is the author of 'Personal Recollections of Distinguished Generals'; 'A Noble Treason,' a tragedy; and 'The Ring Master.'

Shannon, shăn'ŏn, **Wilson**, American politician: b. Belmont County, Ohio, 24 Feb. 1802; d. Lawrence, Kan., 30 Aug. 1877. He had a collegiate and law training and began practice at St. Clairsville, Ohio. In 1832 he became attorney for Belmont County, and in 1838 Democratic governor of the State. After the interim of one term he was re-elected in 1842. During 1844–5, until the suspension of diplomatic relations, he was minister to Mexico by appointment of President Tyler; and after his return he practised law in Cincinnati. He was elected to Congress in 1852, where he served on the committee on foreign affairs. In 1855 he was appointed by President Pierce to succeed Andrew H. Reeder as governor of Kansas. The contests of the pro- and anti-slavery factions among the people to gain possession of the legislature made the post an exceedingly onerous one, especially for one who endeavored to administer affairs impartially. He resigned in August of the following year. After the political troubles of Kansas had subsided he returned to the State to reside.

Shannon, a river in Ireland, the largest in the United Kingdom; rises at the foot of Mount Cuilcagh in the northwest of County Cavan, flows west, southwest, through Lough Allen, then takes an irregular course, generally south, to Lough Rea, then southwest to Lough Derg, then south to Limerick where it becomes a tidal stream. From here on to its mouth are several expansions and it enters the ocean by a broad estuary. The various lakes through which it passes are in part real lake basins and partly river expansions. The total length is 254 miles. By means of improvements which cost about $5,000,000, the river has been made navigable from Lough Allen to Limerick, and the Grand and Royal canals, which connect the river with Dublin, have increased its commercial importance.

Shari, shä'rē, a large river in Central Africa, which enters the south side of Lake Tchad by several mouths after a course of about 700 miles from the southeast. See TCHAD, LAKE.

Shark-sucker. See REMORA.

Sharks, an extensive group of elasmobranch fishes of the order *Selachii*, in which the claspers are complex in structure and the pectoral fins supported on the shoulder-girdle by three basal axial cartilages which may be more or less subdivided, and which bear the cartilaginous fin rays chiefly or exclusively on one side. The external parts of the fins are supported by delicate horn-fibres or actinotrichia. From the rays and skates the sharks are distinguished by the position of the branchial clefts, which are always lateral, by the fan-shaped pectoral fins, which, with few exceptions, have restricted bases, and by the shape of the body, which is almost always elongated, rounded and tapering to the strongly heterocercal tail.

The sharks breathe by gill-sacs or pouches, which open externally on the neck by gill-slits, of which there are five to seven pairs. Water may also be admitted to the gills through the spiracles, a pair of openings on the upper side of the head representing an anterior pair of gill-slits which are never large and often absent. The mouth exists on the under surface of the head, a conformation compelling some of these fishes to turn on their backs to bite conveniently objects at the surface. The skin is usually provided with small tooth-like granules in the form of placoid scales; and is used under the name of *shagreen*, in the manufacture of various articles, such as purses, spectacle-cases, or as a substitute for sandpaper. The eggs may be laid in capsules or cases of horny material, within which the embryos are protected, the egg-cases being moored or fastened by filaments to rocks or fixed objects, and the young form escaping in due time from its covering. The egg-cases of dog-fishes are frequently cast up on the shores, and receive the fanciful or popular name of "mermaids'-purses," "sea-purses," and the like. The majority of the sharks are, however, viviparous and in some the embryos are nourished by means of placenta-like structure. The skeleton never attains a high degree of perfection, but is chiefly cartilaginous. The skull exhibits no indications of divisions into distinct cranial bones, although the jaws are well developed and calcified. The lower jaw is attached to the skull, except in one small group, by means of a hyomandibular cartilage and the upper jaw is the pterygopalatine cartilage. And, as in ganoid fishes, the intestine is provided with a spiral valve which serves to increase the area over which the food has to pass, and the base of the aorta contains rows of valves.

The species of sharks are numerous and so varied in structure that the living forms alone have been arranged in about 20 families. With the single exception of *Eulamia nicaraguensis*,

Digitized by Google

which inhabits Lake Nicaragua, all are marine, only a few occasionally entering the large rivers of India. Owing to their active, roving habits, most of them are widely distributed. With perhaps half a dozen exceptions all sharks are strictly carnivorous and predaceous, and because of their ferocity several of the large species are justly feared. A few of the most noteworthy species are the following:

The white shark or man-eater (*Carcharodon carcharias*) is white below and brown on the upper parts. It is probably the best known of the sharks, and is found in most seas. (See MAN-EATER.) The blue shark (*Carcharinus glaucus*), also known as man-eater, is slaty-blue on the upper, and white on the under parts. It may attain a length of 20 feet or more, and is exceedingly destructive to shoals of food-fishes, pursuing its prey even into the fishermen's nets. Both of these occur occasionally on our coasts, where the dusky shark (*C. obscurus*) closely related to the last, but smaller, is very common. The thresher shark (*Alopias vulpes*), is known by the exceedingly elongated upper tail-lobe, which the fish uses after the fashion of a powerful flail. It feeds chiefly on fishes, and occasionally visits our coasts. The average length varies from 12 to 15 feet. A very common small species along the Atlantic coast is the sand shark (*Carcharias littoralis*) which has very acute teeth mostly provided at the base with one or two cusps. The hammer-headed shark (q.v.) is at once recognized by the lateral elongation of the head to form a hammer-like structure. The porbeagle shark (*Lamna cornubica*) may attain a length of six feet, and is grayish-black. It has slender, very acute teeth and is quite a common visitor to our coasts, where it is also known as the mackerel-shark. The basking-shark (*Cetorhinus maximus*) attains a length of from 30 to 36 feet, being the largest of all sharks, and is found around our coasts but is chiefly an Arctic species. The name is derived from its habit of lying motionless on the surface of the water in the sun, often in schools. It is sluggish and, in spite of its huge size, harmless and feeds on fish. The head and teeth are small, the dorsal fin very large and the gill-slits long. The Greenland, northern, or sleeper shark (*Somniosus microcephalus*), attains a length of 18 feet, and is brown, shaded with deep blue. It feeds upon the carcasses of whales, even attacks living whales, and is chiefly found in the Arctic seas. The spinous shark (*Echinorhinus spinosus*) is so named from the presence of the spiny scales scattered over its integument. The average length is seven or eight feet. It is common on the Atlantic coasts of Europe and Africa, and has been taken once on Cape Cod.

Of the dog-fishes (q.v.) may be mentioned the smooth dog (*Galeus canis*), and the picked dog-fish (*Squalus acanthias*). Two very remarkable sharks representing groups now nearly extinct are the Port Jackson shark (see CESTRACIONT) and the frilled shark (*Chlamydoselache anguineus*). The former is remarkable for the pavement-like teeth and stout fin-spines and the latter for its eel-shaped body, diphycercal tail, frilled gill-clefts and prominently lobed teeth. The former occurs in Australian, the latter in Japanese waters. Another very recent discovery in the latter region is *Mitsukurina owstoni*, unique among living sharks in its prolonged snout and protruding mouth. The saw-sharks (*Pristiophoridæ*), which bear a doubly serrate process on the snout like the sawfishes (q.v.), are otherwise shark-like; and the angel-sharks. (*Squatinidæ*), with much flattened bodies, lead to the skates and rays.

The varieties of extinct sharks are still more numerous and vary from the delicate little acanthodians, only a few inches long, of the Carboniferous, to the huge Tertiary carcarodons, whose five-inch teeth indicate a length of 75 feet. Many of the Palæozoic sharks were of types very different from any now living.

The liver of some sharks contains a large quantity of oil, and they are accordingly caught in great numbers in some places, and the oil extracted. Shark-fishing constitutes an industry of some importance on the coast of Russian Lapland and the northern portion of Norway. Those caught here are chiefly the basking shark and the Greenland shark. The Norwegians employ decked vessels of 20 to 30 tons burden, which carry on the fishery as much as 100 or 150 miles from land, at depths of 250 to 300 fathoms. These vessels carry five or six men. On the coast of Norway, farther to the south, other species of sharks are also caught. In order to attract the sharks the fishermen take an old barrel pierced with several holes, pour oil or grease of some kind into it and sink it to the bottom with stones. The oil or grease escapes slowly, and is carried by the currents to a distance, thus attracting the keen-scented fishes to the place where the boat is stationed. Here they are caught by hooks baited with salted seal's flesh and fastened to the end of strong chains. When a shark is hooked three of the men haul in the chain, while a fourth stands ready with a mallet, weighing about 20 pounds, to stun the fish when its head appears.

The fisheries of China, India and Africa, which have for their object the white shark and other large species for the purpose of supplying the sharks-fin trade of China, are also of great value, and capture annually a total of not less than 100,000 sharks. In the United States shark fisheries have never been developed extensively, practically the only one worthy of mention being the dog-fish industry of New England and particularly of Maine, where the livers of the spiny or picked dogfish are tried for oil and the flesh ground into a poultry food. Dogfish oil is used by curriers and as an adulterant of cod-liver oil. In Europe the dog-fish fisheries are far more extensive and, besides the oil secured from the livers, the flesh yields an extract which for nutritive properties compares favorably with extract of beef. A splendid industrial field along this line seems to await development in the United States.

Consult: Jordan and Evermann, 'Fishes of North and Middle America' (Washington 1896); Goode and Bean, 'Oceanic Ichthyology' (Washington 1895); Goode, 'Fisheries Industries of the United States' (Washington 1884); Dean, 'Fishes, Living and Fossil' (New York 1895; Kingsley, 'Standard Natural History,' Vol. III. (Boston 1885); Gunther, 'Introduction to the Study of Fishes' (Edinburgh 1880);

Digitized by Google

Woodward, ‹Vertebrate Paleontology› (Cambridge 1898). JOHN PERCY MOORE,
University of Pennsylvania.

Sharon, shăr'ŏn, Pa., borough in Mercer County; on the Shenango River, and on the Pennsylvania, the Erie, and the Lake Shore & M. S. R.R.'s; about 40 miles south-southwest of Meadville, and near the Ohio boundary. It is in a coal-mining and iron ore region, and its chief industries are connected with the mining and shipping of coal and of iron and steel products. The principal industrial establishments are furnaces, rolling mills, foundries, nail factories, machine shops, tile and brick works, boiler works, a brewery, a planing mill, and a furniture factory. There are also manufactured a large amount of brass and steel products. The stone quarries, in the vicinity, furnish employment to a number, and contribute to the prosperity of Sharon. The principal public buildings are the business blocks, churches, and schools. The educational institutions are Hall Institute (Baptist), founded in 1888, Saint Scholastica Academy (R.C.), a high school, four public schools, two parish schools, a public school library, founded in 1877, and several private schools. The two national banks have a combined capital of $250,000. Pop. (1910) 15,270.

Sharon Springs, N. Y., village in Schoharie County; on the Delaware & Hudson railroad; about 60 miles west by north of Albany. It is in a valley about 1,100 feet above the sea. It is a famous summer resort, on account of its picturesque location and its four noted mineral springs, a white sulphur, a blue sulphur, a magnesia, and a chalybeate. Pop. about 800; in the summer season, about 10,000.

Sharp, Abraham, English mathematician: b. Little Horton 1651; d. Yorkshire 15 July 1742. Having studied and taught mathematics in Liverpool, he was employed by John Flamsteed in the Greenwich observatory and made for him, in 1688–9, Flamsteed's first successful instrument, a mural arc. Afterward he taught mathematics in London, and subsequently retired to Little Horton, where he devoted himself to mathematics and to making astronomical and calculation instruments, and is said to have been the first Englishman to make these accurately. He published a book of logarithms, the first of its kind, was a joint author with Crosthwait of ‹The British Catalogue,› and plotted a number of important astronomical maps.

Sharp, Becky, the leading character in Thackeray's novel, ‹Vanity Fair› (1847). In the notes contributed by Thackeray's daughter, Mrs. Ritchie, to the ‹Biographical Edition› of Thackeray's works, she makes the statement that she once saw the lady who was supposed to have unconsciously sat for the portrait of Rebecca Sharp. Literary gossip contains a story, current for a time, that Becky was the portrait of Charlotte Brontë and that Miss Brontë retaliated by drawing Thackeray as Rochester in ‹Jane Eyre.› The character has been incorporated into a drama by J. M. Barrie in 1893; by Langdon Mitchell, and by Robert Hitchens and Cosmo Gordon Lennox in 1901.

Sharp, Granville, English abolitionist: b. Durham 10 Nov. 1735; d. London 6 July 1813. He studied law, but abandoned it to accept a place in the ordnance office. He was the patron of the slave Somerset, whom he found in the streets of London in 1769, having been turned away by his master because of illness. Sharp placed him in a hospital, and on his recovery procured employment for him. Two years later Somerset was claimed by his master, arrested and imprisoned, whereupon Sharp summoned them both before the lord mayor, who discharged the slave. The master still refusing to release him, Sharp brought the case before the court of the king's bench, which resulted in the famous decision against the legality of slavery in England in 1772. In 1777 he resigned from the ordnance office because of his disapproval of the American war, and devoted himself thereafter to philanthropy, particularly to the overthrow of slavery. He was chairman of the meeting which in 1787 formed the Association for the Abolition of Slavery and was one of the founders of the negro colony at Sierra Leone. He was also an advocate of parliamentary reform, opposed dueling, and favored the extension of privileges to Ireland. He wrote 61 pamphlets in reference to the causes to which he devoted his life, among which are: ‹Representation of the Dangerous Tendency of Tolerating Slavery in England› (1772); ‹Treatise on Duelling›; Account of the English Polity of Congregational Courts› (1786); etc. His biography was written by Prince Hoare (1810) and by Charles Stuart (1836).

Sharp, James, Scottish ecclesiastic: b. Castle of Banff 4 May 1613; d. Magus Muir, Saint Andrews, 3 May 1679. He was educated at the University of Aberdeen, and was appointed regent there, where his conduct won him the friendship of the clergy. He held a professorship in Saint Leonard's College, Saint Andrews, and was then appointed minister at Crail, Fifeshire. In 1656 he was a representative from the Presbytery to Cromwell, and he managed this mission so well that he was sent in 1660 to Monk and to Charles II. He treacherously agreed to help Monk restore Episcopacy in Scotland, but the time for this coup not being ripe he played the double part of friend to his constituents and tool of Monk. When Parliament established Episcopacy in 1661, Sharp benefitted from both parties, being appointed professor of theology in Saint Mary's College, Saint Andrews, and king's chaplain for Scotland. He now completely went over to the king's party, was consecrated archbishop of Saint Andrew's and primate of Scotland. In 1663 he secured the establishment of a high court commission, in which he took precedence of the chancellor, and the odious persecutions of the Resolutioners by this court, especially the cruelties it inflicted after the uprising of Pentland, made Sharp an object of intense hatred throughout the country, a hatred shared by the king and court, whose tool he was regarded. Falling by accident into the hands of a party of his enemies in 1679, he was dragged from the coach in which he was riding with his daughter, and was beaten to death.

Sharp, William, Scottish writer: b. Paisley 12 Sept. 1856; d. Sicily 13 Dec. 1905. He was educated at the University of Glasgow, after which he made a voyage to Australia. In 1879 he settled in London, where he knew

Digitized by Google

Philip Bourke Marston and Dante Gabriel Rossetti, whose lives he later wrote. He was a critic of art and literature and an industrious editor. In the latter capacity he projected the 'Canterbury Poets' and the 'Sonnets of the Century.' His early life in the west highlands of Scotland probably confirmed his taste for Celtic literature, and among his works is a collection made with the assistance of his wife called 'Lyra Celtica.' In verse he published 'The Human Inheritance' (1882); 'Earth's Voices' (1884); 'Romantic Ballads and Poems of Fantasy' (1886); 'Sospiri di Roma' (1891); 'Flower o' the Vine' (1894); 'Sospiri d'Italia' (1904). His fiction includes 'Children of To-morrow' (1890); 'Madge o' the Pool'; 'Wives in Exile' (1898); 'Silence Farm' (1899). He wrote, also, the biographies of Shelley, Heine, and Browning, and 'Literary Essays'; 'Greek Studies' (1903-4). See MACLEOD, FIONA.

Sharp'less, Isaac, American educator: b. Chester County, Pa., 16 Dec. 1848. He was graduated from the Lawrence Scientific School, Harvard, in 1873, was instructor in mathematics at Haverford College in 1875-9, occupied the chair of mathematics and astronomy there in 1879-85, was dean in 1885-7, and has since been president of the college. He has written text-books on astronomy and geometry and also published: 'English Education' (in International Education Series) (1892); 'Quakers in the Revolution'; 'Two Centuries of Pennsylvania History'; etc.

Sharpless, James, American artist: b. England 1751; d. New York 26 Feb. 1811. He began his artistic career in the United States in 1794 with a series of pastel portraits for which some of the most eminent men of the day gave him sittings; and there are still extant by him portraits of Washington, Jefferson, Hamilton, etc. These are treasured in the National Museum at Philadelphia, where they were placed, 40 in all, in 1876.

Sharps, Christian, American inventor: b. New Jersey 1811; d. Connecticut 1874. He developed a taste for mechanics at an early age and practically devoted his life to invention. He was the originator of many ingenious implements, but none of these gave him such fame and remuneration as the rifle which bears his name.

Sharps'burg, Md., a village in Washington County, beautifully situated in a narrow valley, 12 miles south of Hagerstown, about the same distance north of Harper's Ferry, and three miles east of Shepherdstown, on the Potomac. It has no manufactures, but is surrounded by a fine farming country, the chief products of which are corn, wheat, hay, apples, peaches, and other fruits. It is chiefly noted as the scene of the battle of Antietam (q.v.) or Sharpsburg, fought on the outskirts of the village, 17 Sept. 1862, in which more men were killed and wounded than on any other day of the Civil War. Pop. (1890) 1,163; (1900) 1,030; (1910) 1,100.

Sharpsburg (Md.), Battle of. See ANTIETAM, BATTLE OF.

Sharpsburg, Pa., borough in Allegheny County; on the Allegheny River, and on the Pittsburg & W. and the Pennsylvania R.R.'s; six miles northeast of Pittsburg. It is in a coal-mining region. The chief industrial establishments are foundries, blast furnaces, rolling mills, machine shops, bottle works, planing mills, wire and brick works. Other manufactures are oil cans, varnish and japan, chemicals, coal-mining tools, and oil-well machinery. It has large coal yards, and exports annually a large amount of coal and of steel and iron products. It has a high school, public and parish elementary schools and a public library. Pop. (1910) 8,153.

Sharp-shin, a small hen-hawk (q.v.).

Sharp-shooters, the name formerly given to the best shots of a company, who were armed with rifles, and took aim in firing. They are superseded by the better arms and more complete organization of modern armies.

Sharp-tailed Grouse, the northern prairie-chicken (q.v.), a grouse (*Pediœcetes phasianellus*), which has the general habits of the pinnated grouse, but differs among other features in lacking the neck-tufts, in the characteristic form of the tail, in which the central pair of quills are soft, parallel-edged and square-tipped, projecting an inch or two beyond the next pair. It is somewhat more fond of brushy places, and flies more, than does the pinnated grouse, which is steadily encroaching on its northwestern habitat.

Shasta (shäs'tạ) **Indians,** probably from *tsasdi*, "three," referring to a triple-peak mountain. A group of small tribes forming the Sastean linguistic stock of American Indians, formerly occupying the territory drained by Klamath River and its tributaries from the western base of the Cascade range to the point where the Klamath flows through a ridge of hills east of Happy Camp, in northern California and extending over the Siskiyou Mountains in Oregon as far as the confluence of Stewart and Rogue rivers. They consisted of two divisions, marked by slightly divergent dialects, one comprising the Iruwaitsu, Kammatwa, and Kikatsik; the other the Chimelakwe and Katiru. They have practically lost their native customs through contact with civilization, but they were a sedentary people, living in rectangular, semi-subterranean plank houses, and subsisting chiefly on salmon and other fish, acorns, roots, and seeds. They made basket caps, which the women wore, as well as small food baskets, and a rude form of dug-out canoe. They rapidly succumbed to the encroachments of civilization, and while the tribes composing the stock were never populous, their total number in 1903 was only about 20, some of whom are on the Siletz reservation in Oregon. Mount Shasta derives its name from that of these Indians.

Shasta, Mount, a peak of the Sierra Nevada range, in Siskiyou County in California. It is of volcanic origin; about 14,350 feet above sea level, and on its summit are three glaciers, one of which, Whitney, is three miles long. On the slope and near the base are large trees, some 300 feet high. The mountain is conical in form and has been a dormant volcano for a long period.

Shattuck, shăt'ŭk, **Harriette Robinson,** American parliamentary lawyer and educator: b.

Digitized by Google

Lowell, Mass., 4 Dec. 1850. She studied law, was assistant clerk for the Massachusetts House of Representatives in 1872 — a position held by no other woman — and in 1878 was married to Sidney Doane Shattuck. She has published: 'The Story of Dante's Divine Comedy' (1887); 'The Woman's Manual of Parliamentary Law' (1891); 'Advanced Rules of Parliamentary Law' (1895); etc.

Shattuck School, The, a noted college preparatory school at Faribault, Minn., organized in 1865 and controlled by the Protestant Episcopal Church. The corporate name of the Shattuck School and the Seabury Divinity School, which is also at Faribault, is the "Bishop Seabury Mission." The school has 16 instructors and 200 students. The school course is divided into five forms of one year each, and the establishment is managed on the house system. Military drill is obligatory, and there is a cadet corps with four companies, and an artillery platoon with two detachments. The principal buildings connected with the school are the chapel, Shumway, Morgan, Smyser and Whipple halls. The school was named in honor of one of its earliest benefactors, Dr. George Shattuck, the founder of Saint Paul's School, Concord, N. H., and its head master from 1867 has been the Rev. James Dobbin. Since its organization the school has graduated some 2,000 students. Consult Adams, 'Some Famous American Schools' (1903).

Shaw, shâ, **Albert,** American editor and political economist: b. Shandon, Butler County, Ohio, 23 July 1857. He was graduated from Iowa College, Grinnell, Iowa, in 1879, took a post-graduate course in constitutional history and economic science there, and in 1881 began a course in history and political science at Johns Hopkins, taking the degree of Ph.D. in 1884. In 1883-8 and again in 1889-90 he was on the editorial staff of the Minneapolis *Tribune,* in 1888-9 he studied in Europe, and in 1891 established the 'American Review of Reviews,' which he has since edited. In 1884 he published 'Icaria, a Chapter in the History of Communism,' which was translated into German. His other works include: 'Co-operation in the Northwest' (1888); 'Local Government in Illinois' (1883); 'Municipal Government in Great Britain' (1895); and 'Municipal Government in Europe' (1895). The last two mentioned gave him a recognized standing as an authority on questions of municipal government, and he has since written many magazine articles on economic, especially municipal, subjects.

Shaw, Byam, English artist: b. Madras 13 Nov. 1872. In 1878 he went with his family to England, and received his art education at the Saint John's Wood School of Art and the Royal Academy Art Schools (1890-2). In 1892 he began work as an illustrator, and gradually attained success in this line, first painting 'Rose Marie,' being exhibited in 1893. His work was received with favor by art critics, and became immediately popular as well. It is marked by individuality, fertility of imagination, and brilliant coloring. His other pictures include 'Silent Moon' (1894); 'Whither?' (1896); 'Love's Baubles' (1897); 'Truth' (1898); 'Love the Conqueror'; 'A Woman's Protest'; 'The Lady of Shallot.' Among the works he has illustrated are 'Browning's Poems' (1898); 'Tales from Boccaccio' (1899); 'Chiswick Shakespeare' (1900); 'Old King Cole's Book of Nursery Rhymes' (1901).

Shaw, Edward Richard, American educator: b. Bellport, L. I., 1855; d. Yonkers, N. Y., 11 Jan. 1903. He was graduated from Lafayette College, engaged in teaching, and became professor of pedagogy, and later dean of the New York University. He resigned from the university in 1901 and at the time of his death was superintendent of the public schools of Rochester, N. Y.

Shaw, George Bernard, Irish dramatist and critic: b. Dublin 26 July 1856. He went to London in 1876, engaged in socialistic agitation, and in 1884 became one of the founders of the Fabian Society. To the volume of 'Fabian Essays in Socialism (1889) he contributed 'The Basis of Socialism' and 'The Transition to Social Democracy.' During 1886-94 he wrote musical and art criticisms for the 'World,' 'Truth' and the 'Star.' In 1895-6 he contributed dramatic criticism to the 'Saturday Review,' and arrested attention by the vigor and severity of his judgments. In 1892 his first play, 'Widower's Houses,' was produced at the Independent Theatre, and was published as Volume I. of the Independent Theatre series of plays. Between 1880 and 1883 he published several novels, such as 'The Irrational Knot'; 'Love Among the Artists'; 'Cashel Byron's Profession'; and 'An Unsocial Socialist.' Two volumes of interpretative studies, 'The Perfect Wagnerite' and 'The Quintessence of Isben,' deal with the works of Wagner and Ibsen, the former especially concerning itself with Wagner's chief work, 'The Ring of the Niblungs.' In 1898 he published two volumes of 'Plays Pleasant and Unpleasant,' containing the 'Widower's Houses'; 'The Philanderer' and 'Mrs. Warren's Profession'; 'You Never Can Tell'; 'Arms and the Man'; 'Candida' and 'The Man of Destiny.' In 1900 appeared 'Three Plays for Puritans.' He is fearless, vigorous, and witty, a master of irony, and is unhampered by the traditions either of the theatre or of literature. As a dramatist he is resourceful in effective situations; but his plays appeal to a limited public. Consult his preface, 'Mainly About Myself,' to Volume I. of 'Plays Pleasant and Unpleasant' for statement of his point of view.

Shaw, Henry Wheeler, "JOSH BILLINGS," American humorist: b. Lanesborough, Mass., 21 April 1818; d. Monterey, Cal., 14 Oct. 1885. He entered Hamilton College in 1832, but remained only one year. He then went to the West and pursued a number of occupations offered by the primitive frontier life, but returned to the East in 1858, and became an auctioneer at Poughkeepsie. He contributed humorous articles to a local paper under the signature of "Josh Billings," but his writings failed to attract much attention until he employed a style of phonetic spelling resembling his homely method of pronunciation. His first book, 'Sayings of "Josh Billings,"' (1866) had an enormous success. For many years he contributed to the 'New York Weekly.' In 1863 he began to give public lectures, which consisted of detached bits of homely philosophy, usually pointing a moral.

Digitized by Google

The delivery having an inimitable strain of drollery made him a great popular success. He published 'Every Boddy's Friend' (1876); 'Josh Billings' Complete Works' (1876); 'Josh Billings' Trump Kards' (1877); 'Josh Billings' Spice-Box' (1881).

Shaw, John, American naval officer: b. Mount Mellick, Ireland, 1773; d. Philadelphia, Pa., 17 Sept. 1823. After serving on American merchant ships he commanded the schooner Enterprise of the United States navy, and in December 1799 started on an eight months' cruise, during which he engaged in five actions with the French, recapturing 11 American prizes and taking 5 French privateers. In one hour's combat he forced the Flambeau, a French vessel of 100 men and 14 guns, to surrender after half of her men were killed or crippled, while the Enterprise had sustained a loss of but 10. Shaw was raised to the rank of captain; in 1811 he directed the defenses of New Orleans, La., and in 1813 commanded the naval force which recaptured Mobile, Ala., subsequently seeing other service both at home and abroad.

Shaw, Lemuel, American jurist: b. Barnstable, Mass., 9 Jan. 1781; d. Boston, Mass., 30 March 1861. He was graduated at Harvard University in 1800 and became prominent in the practice of law in Boston. He sat in the Massachusetts House of Representatives and Senate 1811–16 and in 1819, and in the State Senate 1821–2 and 1828–9, and was a member of the State constitutional convention of 1820. As chief justice of the Massachusetts Supreme Court 1830–60, he won a high reputation as a jurist. His publications include addresses and orations.

Shaw, Leslie Mortier, American lawyer and politician: b. Morristown, Vt., 2 Nov. 1848. He was graduated from Cornell College, Mount Vernon, Iowa, in 1874, and from the Iowa College of Law in 1876; was admitted to the bar and established a law practice in Denison, Iowa. He was also prominent in local financial circles, and became president of the bank of Denison, and of the bank of Manilla, Iowa. He occasionally took part in the campaign work of the Republican party, but did not become prominent until the campaign of 1896, when his strong advocacy of the gold standard, his skilful handling of statistics and keen arguments in public speaking won him a wide reputation; and he was called upon to speak in many different sections of the country. In 1898 he was president of the International Money Conference in Indianapolis, Ind. In the same year he was elected governor. In 1902 he was re-elected, but resigned the governorship to become secretary of the treasury in President Roosevelt's cabinet, holding that post till 4 March 1907 when he became president of the Carnegie Trust Company of New York.

Shaw, Richard Norman, English architect: b. Edinburgh 7 May 1831. He was educated at Edinburgh where he practised as an architect, being chiefly engaged in the erection of dwelling houses. He has published 'Sketches from the Continent' (1858); and (with T. G. Jackson) 'Architecture, a Profession or an Art' (1891). He has been very successful in planning substantial houses of a plain yet elegant elevation, and to his brick structures of this sort he has imparted a certain dignity and charm which lends to them the personal stamp of good taste a host of followers have imitated, but rarely attained.

Shaw, Robert Gould, American soldier: b. Boston, Mass., 10 Oct. 1837; d. Fort Wagner, Charleston harbor, S. C., 18 July 1863. He studied at Harvard, entered a New York counting-room, enlisted in the 7th New York regiment at the outbreak of the Civil War, and was promoted captain (1862). In 1863 he was made colonel of the 54th Massachusetts, the first negro regiment sent from the free States. The regiment left Boston for the front 28 May, acquitted itself satisfactorily in a skirmish on James' Island, near Charleston, S. C., 16 July, and on 18 July participated with distinction in the desperate attack on Fort Wagner (q.v.). Shaw was killed while leading his troops. The well-known Shaw memorial by Saint Gaudens was placed in 1897 on Boston Commons. Consult Higginson, 'Harvard Memorial Biographies,' Vol. II. (1866).

Shaw, William Napier, English physicist: b. 4 March 1854. He was educated at Emmanuel College, Cambridge, and at the University of Berlin, was elected fellow of Emmanuel College 1877 and was senior tutor there 1890–9. He has published important papers on 'Electrolysis'; 'The Pyrometer'; 'Meteorology' and with R. T. Glazebrook, 'A Text-book of Practical Physics'; etc.

Shaw University, an institution for the education of the colored race at Raleigh, N. C. It was founded under the auspices of the American Baptist Home Mission Society primarily for the education of colored preachers for the Baptist ministry. Henry Martin Tupper, D.D., was appointed president, and organized the first classes in 1865, in a negro cabin on the outskirts of the city; in March 1866 was formed the first class for colored women, and thenceforth the school has been for both sexes. In 1870 the present campus, including a whole city block, was purchased for $15,000; the buildings were put up with brick made by the students. The university obtained a charter from the State legislature in 1875. The organization of the university includes the Normal, Collegiate, Scientific and Industrial departments, the Theological School, the Missionary Training School, the Leonard Schools of Medicine and Pharmacy, and the Law School. The collegiate department includes a preparatory course of two years; the regular college course is four years; the degrees of A.B. and B.S. are conferred. Music is a part of the curriculum. The course in the medical school occupies four years; the Leonard Medical Hospital is a part of the university. Industrial training and work has been a feature from the first, each student is required to do some kind of manual work, and training is given in carpentering, cabinet, bent iron and machine-shop work, mechanical drawing, architecture and blacksmithing, sewing, dressmaking; laundering, and domestic science. There is also a summer school and a night school (established 1899). The most important buildings include Estey Hall, Show Hall, the chapel, the medical dormitory, administration building, industrial building, laundry, Leonard Medical Building, Hall of Pharmacy, hospital, Missionary Training

Digitized by Google

Building. The valuation of all the property is $167,000. The tuition fees are small, and the institution is supported partially by the American Baptist Home Mission Society. The university occupies a leading place in the work of the education of the colored race, and has won the respect of the Southern people. It is unable to meet the demands made upon it, and is obliged to refuse admission to many students. The students in 1910 numbered 525, the faculty 45.

Shawl, a cloth worn loosely over the shoulders, among civilized nations, chiefly by women, but in semi-civilized and barbarous peoples by both sexes. Shawls, on account of their simplicity, are ancient garments. They are mentioned by very old writers and are thought to be alluded to in the Bible (Ezek. xxvii.). The most ancient shawls, as well as the finest are made in Cashmere, where the manufacture has been carried on in the same method for centuries, even the patterns of the shawls changing but little. The material of which cashmere shawls are made is a very fine yarn made from the under wool of the shawl-goat of Tibet. This yarn, known as pashmina, which is in reality a fine thread, commands a high price in the market, from $9 to $12 a pound. The dyeing of the yarn is an operation calling for the utmost care, and the dyes used are permanent. The patterns of the shawls are produced by two methods, by weaving, and by embroidery. Where the design is to be embroidered the ground of the shawl is of a plain pashmina fabric and the thread used is of the same material. Very primitive looms are employed for the manufacture of the loom-woven shawls, and a great length of time is taken in their manufacture. Three or four men sometimes work at one loom, and for some of the finer shawls a year's time is necessary. The more ordinary shawls are produced, however, about five a year, to each loom. Sometimes these shawls are woven in separate portions, and afterward joined together with great skill. Cashmere shawls sell as low as $70 or $80, but one of a first-class pattern and coloring will cost as much as $1,200 to $1,500. Such a shawl will weigh about seven pounds and the texture will be very fine and close and the design intricate. Of the large price of such a fine shawl about $150 will represent the cost of the materials used, $750 the labor expended, and $600 the duty to be paid and other expenses. In the Punjab of India inferior shawls are manufactured at Nurpur, Amritsar, and other places, the art having been carried over from Cashmere. The fine pashmina is not used unadulterated in these, but is mixed with the coarser goat's wool, called kaork. Such shawls are also made at Kerman in Persia. The finest shawls in Persia are also made of silk, and are much like the Cashmere shawls in appearance.

The production of shawls was until recent years a very important manufacture in France, and gave occupation to a large number of designers in Paris, who not only furnished designs for those woven in their own country — chiefly at Paris, Lyons, and Nimes — but also for shawl-manufacturers in England and Austria, and even for some woven in Cashmere. In 1867 it was estimated that the annual value of the French shawl trade amounted to nearly a million pounds sterling. Shawls of various kinds are made at different places in England, and in past years many of these were designed in the Indian style. At Paisley in Scotland, where for many years previous to 1860 the manufacture of shawls was of great importance, the trade originated in the beginning of the 19th century. They were made of silk, wool, or cotton, either separately or in combination; but the best-known class of Paisley shawls was manufactured of fine wool and with patterns in the style of those woven in Cashmere. As many as 8,000 looms were at one time occupied in the weaving of these. Soon after the middle of the century, however, the manufacture began to decline, and for some years past no shawls of this character have been woven. Tartan shawls, but chiefly of small size, for indoor or occasional wear, are still made at several places in Scotland. Wherever the manufacture of shawls has been prominent shawl clothes are also made and are made up into articles of dress for women, and, sometimes, for men, as well.

A few words may be said about the patterns of Cashmere shawls, which have been placed by the most distinguished decorative artists of modern times in the highest order of art manufacture. The most characteristic feature in a typical design is what has been usually called the "cone" or "pine cone." It appears, however, to be really a conventional representation of a wind-bent cypress-tree, as the term *sarv*, the native name of that tree, is also applied to this pattern or part of a pattern. The form has many modifications, one or more of which often make up the groundwork of the designs of other textile fabrics both in India and Persia, and it even appears on metal-work and papier-maché made in Cashmere. Sometimes it is simply called the shawl pattern. It is, however, not merely the graceful outline of their ornamental devices, but also the harmonious blending of their deep-toned colors, which gives a singular charm to these exquisite productions.

Shawnee (shâ-nē') **Indians** (contracted from the Algonquian *Shawanogi*, "southerners"), an important tribe of the Algonquian stock of North American Indians, who, according to the best evidence, were originally an offshoot from the Lenape or Delawares, which migrated southward, hence their popular name. It is believed that they entered the present limits of the United States from the territory north of the Great Lakes via the lower peninsula of Michigan, various bands or divisions settling in southern Illinois, southern Ohio, and (the larger part) on Cumberland River. A portion of the latter drifted southeastward to the headwaters of the Savannah, where they came in contact with the Cherokees and Catawbas, who forced them northward into Pennsylvania by 1707, while those remaining on Cumberland River were driven away by combined Cherokees and Chickasaws. They were first mentioned under the name Ouchaouanag, in 1648, as living to the westward of Lake Huron; later in the century they were found by La Salle in northern Illinois, while others were settled along the Ohio and the Cumberland, and indeed had extended into Maryland, Virginia, and Pennsylvania, and even as far south as Mobile, Ala., in the country of the Creeks. They were at war with numerous tribes at various periods, as well as with the

Digitized by Google

French, and later with the United States, from the beginning of the French and Indian war until about 1795, during which time they had concentrated north of the Ohio River. Anthony Wayne's victory, followed by the treaty of Greenville in 1795, terminated the hostilities of the Indians of the Ohio Valley region, a considerable part of the Shawnees moving to Missouri, within Spanish territory, while a few years later others migrated to White River, Indiana, on invitation of the Delawares. Early in the 19th century, Tenskwatawa, the «Shawano Prophet,» brother of the celebrated Tecumseh, preached a new doctrine the acceptance of which would open the way to future happiness and a return of the old order of things, not unlike the «Ghost Dance» religion which involved so many of the western tribes beginning with 1890. The Prophet gathered many adherents from far and wide, who established themselves at the mouth of Tippecanoe River, Indiana. To overcome their hostile demonstrations, General Harrison in 1811 led an expedition against them, resulting in the defeat of the Indians in the celebrated battle of Tippecanoe and the destruction of their settlement, while the tragic death of Tecumseh, their recognized leader, in the following year, tended to break their hostile spirit. The Shawnees of Missouri sold their lands to the government in 1825 and were assigned to a reservation in Kansas, but meanwhile a large number of them had departed for Texas where they settled on the headwaters of Sabine River until driven out in 1850. In 1831 the Ohio Shawnees ceded their lands to the United States and joined their kindred in Kansas, and in 1845 a large part of these Kansas Shawnees moved to the Canadian River in Indian Territory, where they have since been officially known as Absentee Shawnees. In 1867 the mixed Shawnees and Senecas who had moved from Ohio to Kansas about 1831, also migrated to Indian Territory, where they became known as Eastern Shawnees, and in the meantime the rest of the tribe joined the Cherokees in Indian Territory, with whom they are now incorporated. The Shawnees known as Black Bob's band are those who at first refused to move from Kansas with the others. There are also Shawnees among the Tuscaroras in New York, and others are incorporated among the Teton Sioux, while in 1840 a number of the tribe accompanied a party of trappers to the Tulare Valley of California.

The Shawnees were early described as of good stature, an active, sensible, cheerful people, full of laughter and drollery, courageous, high-spirited, and manly, yet «the most deceitful in human shape.» Each town had its head-man. Polygamy was common and infanticide frequently practised. It was said that most of the Shawnees could speak several languages, due, no doubt, to their roving propensities when occasion required, although they were agriculturists in the main. The tribe had four phratral organizations, the members of which occupied different sides in the council-house during public assemblies. So far as known 13 gentes were recognized. Of the population of the Shawnees in early times there is no reliable information, the estimates ranging from 1,000 in 1736 to 2,000 in 1817. In 1902 there were 94 Eastern Shawnees in Indian Territory, and 737 Absentee Shawnees in Oklahoma. The Shawnees incorporated with the Cherokees are estimated at 800.

F. W. Hodge,
Smithsonian Institution, Washington, D. C.

Shaya Root, the root, or the plant itself, of *Oldenlandia umbellata*, of the madder family, and sometimes called Indian madder. It is a slender branching annual, with narrow opposite leaves, and small flowers in panicles. It grows wild, and is also cultivated, on the Coromandel coast, the outer bark of its roots yielding the well known durable red-dye seen in Indian cotton goods. The leaves have been used as an expectorant in native medicine.

Shays, shāz, **Daniel**, American soldier, leader of the «Shays' Rebellion» in Massachusetts: b. Hopkinton, Mass., 1747; d. Sparta, N. Y., 29 Sept. 1825. He is first heard of as an ensign at Bunker (Breed's) Hill, was made captain 1 Jan. 1777, and resigned from the service. There is testimony that he was a good soldier. The rebellion of 1786–7, in which he was the directing figure, arose from a spirit of unrest and lawlessness then generally on the increase in the country, but more particularly from special reasons for dissatisfaction in Massachusetts. Among these were the wastefulness in the costs of litigation, the high salaries attached to public offices, and above all the exorbitant land taxation. The time was one of financial depression, and Governor Bowdoin in his endeavors to sustain the credit and diminish the debt of the State undoubtedly caused heavy burdens to fall upon poorer citizens inland. Sheriffs' and county courts were kept busy. In the fall of 1786 five or six hundred malcontents, under command of Shays, gathered at Springfield, the purpose being to overawe the supreme court about to sit there, and prevent the finding of indictments. After a three days' session the court adjourned. In November, when the court of general sessions attempted to sit at Worcester, Shays filled the court-room with an armed force, and no court could be held. Washington was deeply alarmed at the reports of these early successes of the insurgents. «It was but the other day,» said he, «that we were shedding our blood to obtain the constitutions under which we now live,— constitutions of our own choice and making,— and now we are unsheathing the sword to overturn them.» An army of 4,400 was now enlisted for 30 days by Governor Bowdoin, and the money for equipment and munitions was raised by a loan from wealthy citizens. The command was given to General Benjamin Lincoln, a Revolutionary veteran. On 25 Dec. 1787 Shays, with 1,100 troops, made an attack on the Springfield arsenal, guarded by General Shepard with 1,200. Shepard at first commanded his men to fire above the insurgents' heads, but as the latter continued to advance in good order, a volley was directed into their ranks. Four fell; and the insurgents retreated in much confusion, continuing their flight, with many desertions, from town to town. Lincoln pursued them to Petersham, where on 3 February 150 were taken and the rest dispersed. The rebels continued to gather in small bands, for some months; but no large force again appeared. The greatest clemency was shown toward the leaders, and a very general amnesty proclaimed. Shays removed to Vermont, was pardoned, and went thence to Sparta, N. Y.,

Digitized by Google

where he obtained a pension for his Revolutionary services. Consult McMaster, 'History of the People of the United States,' Vol. I. (1883); 'New England Magazine,' new series, Vol. XXIII. No. 5 (January 1901); 'Reminiscences of Shays' Rebellion'; Rivers, 'Captain Shays.'

Shays' Rebellion. See SHAYS, DANIEL.

She, a romance by Rider Haggard (1887), a young Englishman goes to Africa to avenge the death of an Egyptian ancestor, whose strange history has come down to him in an old manuscript. The ancestor, a priest of Isis, had been slain by an immortal white sorceress somewhere in Africa. The sorceress, "She" and the Englishman finally meet, recognize a mysterious bond between them, and, at the climax of the story, visit a place where burns a mysterious fire which gives thousands of years of life, loveliness, strength and wisdom or else swift death. "She" for the second time passes into the flame and is instantly consumed.

She-oak, any one of the small trees or shrubs of the peculiar genus (*Casuarina*) of oaks native to the East Indies and Australia. Although closely related to oaks and walnuts, the she-oak has no true leaves, substituting whorls of long drooping, slender deciduous branchlets, and is said to resemble both Scotch firs and giant horsetails, in its wide-spreading top. It casts but little shadow. The branchlets are acidulous in taste and are liked by cattle. A small and round fruit is called the she-oak apple, and is of bitter taste, and used to flavor beer. The wood of the she-oak is extremely hard, makes excellent fuel, and is valuable for woodworking; in some species it is reddish, with light and dark streaks, and is called beef-wood. The Australians make boomerangs and other weapons out of its roots. *Casuarina stricta* is the species known as coast she-oak, or sometimes as he-oak; the forest or erect she-oak is *C. suberosa;* and the desert one is *C. glauca.*

She Stoops to Conquer, or The Mistakes of a Night, a comedy by Oliver Goldsmith, first produced 15 March 1773, and said to have been founded on an incident in the author's own life.

Shea, shā, **John Dawson Gilmary,** American historian: b. New York 22 July 1824; d. Elizabeth, N. J., 22 Feb. 1892. His father was principal of the Columbia College Grammar School where he gained his education, and subsequently he studied law and was admitted to the bar in 1846. He soon turned to literature, was connected in an editorial capacity with Frank Leslie's publishing house, and later edited the 'Catholic News.' But for many years his attention was given to historical research in preparation of his 'History of the Catholic Church in the United States,' the 4th volume of which was in process of publication at the time of his death. He was connected with many historical societies in America and Europe and was the first president of the Catholic Historical Society of the United States. His published works include: 'The Discovery and Exploration of the Mississippi Valley' (1853); 'History of the French and Spanish Missions among the Indian Tribes of the United States' (1854); 'The Catholic Church in Colonial Days' (1883); 'The Hierarchy of the Catholic Church in the United States' (1886), besides many translations and other works.

Sheard, shĕrd, **T. F. M.,** English painter: b. Oxford 16 Dec. 1866. After his graduation in 1889 he went to Paris and studied painting under Courtois, Rixens, Lefèbre and Rigolot. He has since then exhibited at the Salon, Royal Academy, and the Royal Institute of Water Color Painters. He was awarded a bronze medal at the Paris Exhibition of 1900. He is fond of eastern subjects, and scenery flooded with sunlight, and among his paintings of this character are 'A Market Morning in a City of the Sahara'; 'An Arab Blacksmith'; etc. Among his scenes of English peasant life may be mentioned 'Birds of a Feather'; 'The Outcast'; 'Parted'; etc.

Shearman, shĕr'man, **Thomas Gaskell,** American lawyer: b. Birmingham, England, 25 Nov. 1834; d. Brooklyn 29 Sept. 1900. At nine he came to America with his parents and in 1857 took up his residence in Brooklyn. He was admitted to the bar in 1859, and in 1868 formed a partnership with David Dudley Field. Later John W. Stirling entered the firm which was continued after 1873 by Shearman and Stirling. This firm defended Jay Gould in suits resulting from the gold panic of 1869, and Henry Ward Beecher in the suit brought against him by Theodore Tilton. Shearman was an advocate of absolute free trade and a vigorous propagandist of Henry George's single tax theories. From early years he contributed to legal literature, and was joint author of 'Tillinghast and Shearman's Practice, Pleadings and Forms' (1861–5), and 'Shearman and Redfield on Negligence' (1869). He prepared for the commissioners of the New York code, the 'Book of Forms' (1861), and the major part of the civil code relating to obligations (1865). He also published 'Talks on Free Trade' (1881); 'Pauper Labor of Europe' (1885); 'Distribution of Wealth' (1887); 'Owners of the United States' (1889); 'The Coming Billionaire' (1890); 'Crooked Taxation' (1891).

Shears. See CUTLERY; HARDWARE.

Shear'water, a sea-bird which skims close to the surface of the water in search of fishes and floating animal matter upon which it feeds. The shearwaters are larger than the petrels, and differ from both them and the fulmars in their long, slender bills, both mandibles of which are hooked at the end, and by the short broad nostril-tubes. The wings are long and narrow, and the tail rounded or wedge-shaped, never forked. In habits they generally resemble the petrels (q.v.). Ten species are recorded as occurring on the North American coast, the best known being the common shearwater (*Puffin major*) and the sooty shearwater (*P. stricklandi*). Sailors call these birds "mutton-birds," because of the excessive fatness of the young which are good eating, and the search for which has nearly exterminated the once common British species (*P. brevicauda*). Consult Newton, 'Dictionary of Birds' (New York 1896).

Sheath-bill, a family of limicoline birds (*Chionididæ*) belonging to the order related to the plovers. The wings are long and pointed, the tail being of moderate size. The bill is short and stout, compressed, strongly arched at its tip, and provided at the base with a horny sheath

Digitized by Google

which protects the nostrils. The tarsi are short and stout. The white sheath-bill or kelp-pigeon (*Chionis alba*) is the best known species. It inhabits the shores of the islands off the southern end of South America. Its color is pure white, the legs reddish-black, and its average length 15 inches. These birds feed on mollusks, carrion, fishes, crustacea, seaweeds and other food which they can pick up on the seashores. On land they much resemble pigeons, but when flying in flocks at sea are gull-like in aspect. Cook in his third voyage says its flesh is equal to duck, but other accounts represent the flesh as very unpalatable, probably on account of the bird's food.

Sheba, shē'ba, or **Saba',** Arabia, the ancient capital of Arabia Felix. Its site has not been determined, but it was a great commercial centre of the Semitic tribes. The Sabæns carried on an extensive trade with India, Europe, Egypt and Syria, in frankincense, gold, ivory, ebony, fine textiles, and sweet spices, and for this purpose had depots in northern Arabia and Ethiopia. Their wealth became famous in the Orient, and their queen paid a visit to Solomon with rich gifts, as cited in the Scriptures. They worshipped natural objects, especially the sun and moon. In the 8th century they were subject to the Assyrians; in 24 B.C. the Romans sent an unsuccessful expedition into their territory, and in the 2d, 4th and 6th centuries, they became subject to the Ethiopians.

Sheboygan, shē-boi'gan, Wis., city, county-seat of Sheboygan County; on Lake Michigan at the mouth of Sheboygan River, and on the Chicago & Northwestern railroad; about 50 miles north of Milwaukee and 100 miles, in direct line, northeast of Madison. It has a good harbor and steamer connections with the principal lake ports. A regular line of steamers ply between the city and Milwaukee and Chicago during the navigation season. The first settlement was made in 1836; the place was incorporated as a village in 1846, and in 1853 was chartered as a city. Sheboygan is the commercial and industrial centre for a large and fertile agricultural region. The chief industrial establishments are five chair factories, in which there are over 2,000 employees; 11 furniture factories, foundry, boot and shoe factories, a shipyard, lime kilns, brick works, machine shops, enameled ware works, tanneries, carriage factories, planing mills, boiler works, and soap factory. It has large warehouses, five for cheese alone. The government census for 1900 gives as the number of manufacturing establishments, 206, and the number of employees in the same, 5,540. The amount of capital invested, $7,766,616; annual amount paid for wages, $1,928,167; for raw material, $3,995,102; and the value of the product, $7,469,202. The chair factories, for which Sheboygan is noted, turn out about 7,000 chairs each day; and the value of the annual output from the furniture factories is over $3,000,000. The principal public buildings are a government building, county courthouse, municipal buildings, the churches and schools. There are two parks; in one, Fountain Park, is an artesian well, the waters of which contain considerable mineral salts and are of commercial value to the city. There are 20 churches, an asylum for the chronic insane, a Home for the Friendless, and Saint Nicholas Hospital. The educational institutions are a day school for the deaf, a high school, public and parish elementary schools, a public school library containing about 5,000 volumes. The two state banks have a combined capital of $300,000. The growth of the city has been rapid; but business men have been attracted to the place as one in which manufacturing industries have been most successfully conducted. Pop. (1880) 7,314; (1890) 16,359; (1900) 22,962; (1910) 26,398.

Shechinah. See SHEKINAH.

Shedd, shĕd, **William Greenough Thayer,** American theologian: b. Acton, Mass., 21 June 1820; d. New York 17 Nov. 1894. He was graduated from the University of Vermont in 1839, from Andover Theological Seminary in 1843; and in 1844–5 was pastor of the Congregational Church in Brandon, Vt. He was professor of English literature in the University of Vermont in 1845–52, of sacred rhetoric and pastoral theology at Auburn Theological Seminary in 1852–3, and of ecclesiastical history and lecturer on pastoral theology at Andover in 1853–62. He acted as assistant pastor at the Brick (Presbyterian) Church, New York, in 1862–3, was appointed to the chair of Biblical literature at Union Theological Seminary, New York, in 1863, and in 1874 was transferred to that of systematic theology, which he occupied until 1890. His publications include: 'The Method and Influence of Theological Studies' (1845); 'The True Nature of the Beautiful and its Influence upon Culture' (1851); 'The Nature and Importance of Natural Rhetoric' (1851); 'Lectures on the Philosophy of History' (1856); 'A History of Christian Doctrine' (1863); 'Homiletics and Pastoral Theology' (1867); 'Sermons to the Natural Man' (1871); 'Theological Essays' (1877); 'Literary Essays' (1878); 'Commentary on St. Paul's Epistle to the Romans' (1879); 'Sermons to the Spiritual Man' (1884); 'Doctrine of Endless Punishment' (1885); 'Dogmatic Theology' (1889–94); 'The Proposed Revision of the Westminster Standards' (1890); etc. He also published 'Eloquence a Virtue, or Outlines of a Systematic Rhetoric' (1850), a translation from the German of Dr. Francis Theremin; 'A Manual of Church History' in two volumes, translated from the German of Heinrich Ernst Ferdinand Guericke (1857); edited seven volumes of Coleridge's works, with 'Introductory Essays' (1853); 'The Confession of Saint Augustine,' with introductory essay (1860); and wrote introductions to Asbury's translation of Ackerman's 'The Christian Element in Plato and the Platonic Philosophy' (1860), and to McCosh's 'Intuition of the Mind' (1864).

Shee, shē, SIR **Martin Archer,** English painter: b. Dublin 23 Dec. 1770; d. Brighton, England, 13 Aug. 1850. He was introduced in 1788 to Sir Joshua Reynolds by Edmund Burke, and in the same year became a pupil in the Royal Academy, to the exhibition of which he contributed his first picture in 1789. Although by no means the best portrait painter of his time, he was, with one or two exceptions, the most fashionable. In 1800 he was chosen a member of the Royal Academy, and in 1830 on the death of Sir Thomas Lawrence, he was elected president and knighted. He also aspired to literary distinction, and in 1805 and 1809 published two parts of a poem entitled 'Rhymes on Art.' in 1814 'The Commemoration of Sir Joshua Reynolds, and other Poems,' which called forth the praise of

Digitized by Google

Byron, in his 'English Bards and Scotch Reviewers':

> And here let Shee and genius find a place,
> Whose pen and pencil yield an equal grace;
> While honors, doubly merited, attend
> The poet's rival, but the painter's friend.

Among his portraits are those of William IV. and Queen Victoria; all his work is pleasing, but there is an unpleasant tendency to unnatural redness in his flesh tints.

Shee'dy, Morgan M., American Roman Catholic clergyman: b. Ireland 8 Oct. 1853. He was ordained priest in 1876. He was the first president of the Catholic Summer School, and is editor and publisher of the 'Church Quarterly.' He is a frequent contributor to magazines and a popular lecturer. He has been rector of Saint John's Church, Altoona, Pa., since 1894, and has published 'Christian Unity' (1895); 'Social Problems' (1896).

Sheep, Domestic, sheep bred, modified and reared for the sake of utilizing their flesh or wool. Sheep breeding dates back to antiquity. Jewish and Roman writers have left records of their systems of breeding. The Romans realized the suitability of Spain for sheep-breeding and the superiority of the flocks found there. White sheep were obtained and bred to the black or parti-colored flocks which, according to Pliny, were the common stock. The Tarentine sheep were the most celebrated in Italy, but being delicate they became extinct with the fall of the Roman Empire. The merinos were introduced into Spain from Asia Minor, and being hardy, they survived the conquest of Spain by the Goths and Vandals. Subsequently the government extended protection to and developed the breed. In England considerable attention was paid to sheep-breeding, and in the 13th century an export duty was levied on wool. In 1464 the wool of the Spanish merinos was greatly improved by interbreeding with Cotswold sheep of England. In 1765 and 1778 Spanish merinos were introduced into Saxony and laid the foundation for the Saxon merino, the finest-wooled sheep known. In 1787 merinos were introduced into England, but as they were not mutton and wool producers combined they found little favor.

American Flocks.— No domesticated sheep were found in America. The big-horn (q.v.), or wild Rocky Mountain sheep, were known to the first settlers, but efforts to domesticate them and cross them with domesticated sheep have proved failures. The early introductions were made by the Spanish discoverers and the English settlers; Columbus brought Spanish sheep to America in 1493, which were the progenitors of large flocks in New Mexico, Utah and Texas. In 1565 Spanish sheep were introduced into Florida and in 1773 into California; the latter multiplied rapidly under the care of the priests of the missions and in 1825 17 of these missions owned 1,003,970 sheep, exclusive of those owned by ranchers. Sheep were introduced into Virginia from England in 1609, into Massachusetts from England in 1824, and into New York from Holland in 1625. The characteristics of the several original breeds were blended by continued crossing, and further modified by importations made between 1783 and 1799, the result being a stock known in 1800 as "native" sheep. The "native" sheep of the Middle and Eastern States along the Atlantic coast as far south as Georgia and as far west as English-speaking settlers had gone, were of a long-wooled type. Those of the South Atlantic States, the Gulf Coast, Texas and the Pacific Coast, were of Spanish origin, the scrubs of to-day, which are fast disappearing. A few merinos were found in the North Atlantic States.

About 1810 with the desire of developing home manufactures and home wool production, 26,000 of the finest Spanish merinos were introduced and distributed. The failure of manufactures in 1815–16 led to the slaughter of entire flocks. In 1820 trade revived and a finer wool was required, which resulted in the importation of Saxon merinos in 1822–3. With the passage of the tariff in 1828 wool declined in value and sheep of Spanish origin again gained ground because they were hardier and produced better mutton. In 1842 the manufacture of worsted goods called for longer fleeces. Between 1845 and 1855 the change was made from fine-wool sheep to coarse-wool and mutton sheep. Between 1860 and 1870 various mutton breeds were imported and distributed, but the quality of the wool of many was unsatisfactory. The French sheep (Rambouillets) produced good mutton and a finer combing wool than the English breeds and crossed well with the merino ewes. The various strains of Delaine merinos originated at this time. In 1870 more than four fifths of all the sheep in the United States were either purely bred or grade merinos. There were a few Downs and small flocks of various long-wooled breeds in the Middle States and in the Ohio Valley, and some degenerate Mexican sheep in Texas and New Mexico. With the increase of population in the East and Middle West, mutton became of more value than wool, and mutton breeds displaced the merino. To-day the merino and English types of sheep are nearly equal in number, the former predominating in the range territory and the latter in the farming States. Estimates show that the mutton breeds constituted about 30 per cent of the flocks on the ranges, and 70 to 80 per cent of those in the farming States. The tendency to-day is toward a sheep carrying fine wool and a good carcass.

In 1850 the number of mature sheep in the United States was 24,000,000, the leading States being New York and Ohio. Until 1860 the number remained stationary, but at the 1870 census it had increased to 28,471,275. In 1880 it reached 42,876,312, and has remained about 40,000,000 since, the 1900 census showing 31,919,298 ewes and 8,018,275 rams and wethers. The lamb crop is, generally speaking, about two thirds the number of ewes; in 1900 the number of lambs dropped and reared to 1 June, or sold fat, per 1,000 ewes, was 689, being highest in the North Atlantic States with 758, closely followed by the South Atlantic States with 730, North Central with 716, and lowest in Hawaii with 284. In 1889 the census showed that the number of sheep and lambs which died from exposure or were killed by dogs was equal to 25 per cent of the lamb crop. The total number of sheep and lambs on 1 Jan. 1910 was 57,216,000 valued at $4.08 per head, or $233,664,000. The total value the previous January was $192,632,000. The highest values per head in the year 1910 were in March, $9.30 $4.54 and April, $8.75, the lowest being in November, $2.00 and September $2.10. The number of sheep and lambs in the

Digitized by Google

leading States and territories in April, 1910, were Montana, 4,800,000; Wyoming, 4,650,000; New Mexico, 3,200,000; Idaho, 2,600,000; Ohio, 2,600,000; California, 1,900,000; Oregon, 7,750,000.

Breeds.— The breeds of sheep may be classified according to the length of their wool, as long, medium, and short-wooled, and the mountain sheep, the wool of which is more like hair. The long-wooled breeds include the Lincoln, Cotswold, Leicester, and Romney Marsh. The medium and short-wooled breeds include the Down breeds, namely, Southdown, Shropshire, Hampshire, Suffolk and Oxford, the Dorset, Cheviot, and various types of merinos. The hill breeds include the Black-faced Scotch and Welsh Mountain sheep. The Lincoln is the heaviest sheep in existence. The Cotswold is one of the oldest English breeds, and in the 12th century its wool was a source of great wealth. The Leicester breed was greatly improved by Robert Bakewell, who began work in 1755 and received very high prices for his sheep; the mutton qualities of these breeds were inferior but have been improved considerably during late years. The Southdown is the ideal mutton sheep, and has been used to a great extent for crossing. The Shropshire is well known and somewhat similar but larger than the Southdown. The other Down breeds are increasing in popularity. The Dorsets have horns and the ewes sometimes yean twice a year. The Cheviots are named from the hills on which they originated and are a hardy breed. The black-faced Scotch and Welsh sheep are small and hardy and furnish ideal mutton. The merinos originally were bred primarily for wool; present day strains, as Rambouillets, the various Delaines, and American merinos furnish fine wool and a good carcass. As the Mohammedans cannot eat swine's fat, they developed sheep which have very fat hind quarters and tail, examples being the fat-tailed sheep of Tartary and the fat-tailed Syrian sheep, the tails of which weigh 70 to 80 pounds and are supported on little trucks attached to the animal and dragged about with it.

Nomenclature.— The male sheep is called a «ram,» the female a «ewe,» and the young a «lamb»; castrated males are «wethers.» The flesh of the adult is «mutton»; of the young, «lamb.» The entrails furnish sausage cases and are also dried and twisted into «catgut» strings for musical instruments. The prepared fat makes «tallow» or «suet.» The coat or fleece is «wool,» and the prepared hide is «sheepskin,» which is used for many purposes.

Diseases.— Sheep-pox (*Variola ovina*) is an acute, contagious febrile disease of sheep, somewhat similar in appearance to smallpox. This disease, although unknown in the United States, has given trouble in Europe, attacks being attended by a mortality of from 10 per cent to 50 per cent. Pneumonia, blackleg or quarter-ill, and foot-and-mouth disease attack sheep (see RINDERPEST). The sheep tick, louse or ked (*Melophagus ovinus*) is a wingless insect, a quarter of an inch long, brownish and with flattened abdomen, which lives in the wool and causes considerable injury by puncturing the skin to extract blood. The best treatment is dipping the sheep in solutions of poisons, as carbolic acid or arsenic, and placing them on new feeding grounds. Gid or sturdy is due to the presence on the brain or spinal cord of the cystic or bladder-worm form (*Cœnurus cerebralis*) of a tapeworm (*Tænia cœnurus*) of the dog. The cyst may be removed through an opening in the skull, and further trouble prevented by caring for the dogs, expelling tapeworms by vermifuges, and denying them sheep's heads unless cooked. Husk or hoose is caused by the presence of thread worms (*Strongylus filaria*) in the windpipe, bronchi or tissues of the lungs, causing irritation, coughing, emaciation and often death. Scab (*Acarus scabiei*) is due to a minute mite which burrows in the skin, causing intense irritation or itching. The secretions exuded form a scab. If neglected, the wool falls off. The Bureau of Animal Industry of the U. S. Department of Agriculture is pursuing vigorous measures to stamp out this disease, all infested sheep or those in contact with such at stock yards being dipped once or twice in one of the three dips, tobacco extract and sulphur; lime and sulphur; or nicotine and sulphur. Dipping does not confer immunity and if the sheep are placed on infested ranges they are liable to a second attack. Liver-fluke or liver-rot is a most destructive affection of sheep, due to the presence of flat, oval, leaf-like, suctorial worms (*Distomum hepaticum*) about one inch long, in the liver or bile-duct. It also affects other animals, including man. The life-history is complex and requires two hosts, the sheep and a fresh-water snail (*Limnæa*). Sheep should be kept off contaminated pastures, and when affected be fed dry food and salt daily, the presence of the latter being fatal to the young flukes as they are eaten. The land should be drained, sown with salt, and in new countries imported sheep from suspected areas should be quarantined. The sheep-bot or sheep nostril-fly (*Œstrus oris*) deposits its maggots on the sheep's nostrils. The larvæ move upward, live in the mucous membranes of the nostril and frontal sinuses for about nine months, are sneezed out, pupate for one month or more, when the fly emerges. To prevent attacks, feed salt from two-inch auger holes bored in a log upon which tar is smeared. The tar gets on the nose and keeps the fly off. Nodular disease (*Œsophagostoma columbianum*) is very prevalent in the Southern States. It is caused by the presence of a small worm, which while immature penetrates the walls of the intestines, causing inflammation and subsequently a small nodule or «knot» filled with cheesy matter and the worm. The digestive system is injured and some sheep die. No remedy is suggested, but the selection of vigorous sheep and the keeping of them on dry land are advised.

The dipping of sheep is a regular institution on well conducted farms. It is usually done soon after shearing and also in the fall, the lambs being dipped at the same time as the rest of the flock. It is either a preventive, as in warding off flies, or a curative measure as already shown. Care must be exercised not to make dips too strong. Carbolic and arsenical dips are often mixed, being fortified by the addition of sulphur to prolong the action of the dip. Sheep should go into the dipping bath face forward to reduce the danger of poisoning and the shock to the nerves, and remain in until the skin is wet. Sheep which have been dipped in poisonous dips should not have access to grass until dry. The wool from dipped sheep is more valuable than that from undipped.

Digitized by Google

Bibliography.— Randall, 'Practical Shepherd' (New York 1860); Youatt, 'Sheep' (New York, revised 1885); Salmon, 'Special Report on the Sheep Industry' (Washington 1892); Law, 'Farmer's Veterinary Adviser' (Ithaca 1900); Shaw, 'The Study of Breeds' (New York 1900); 'Stewart, 'The Shepherd's Manual' (New York 1901); also the 'Flock-books' of the various societies.

SAMUEL FRASER,
Professor of Agronomy, Cornell University.

Sheep-bot, a bot-fly (q.v.) whose maggots produce the disease of sheep called "grub in the head." See SHEEP.

Sheep, Diseases of. See SHEEP.

Sheep-dog. See COLLIE; DOG.

Sheep-laurel, or **Lamb-kill**, the *Kalmia* or mountain-laurel (q.v.), which is poisonous to lambs and other small animals.

Sheep, Mountain, a general term for the wild sheep of the world, which collectively form a group of romantic interest, and scientific importance. Excepting their perpetual rivals, the wild goats and ibexes, they are, of all land animals, the boldest and most active rock climbers, and the most partial to mountain scenery. Wherever found, they inhabit the highest and most rugged and picturesque situations. Strange as it may appear, the haunts of the Rocky Mountain big-horn include not only our loftiest mountain ranges and many wild tracts of "bad lands," but also the rocky walls of the great abyss known as the Grand Cañon of the Colorado. It is not strange, therefore, that all big-game hunters who love grand scenery find great fascination in the chase of wild sheep. No man worthy of the name of sportsman ever kills a ewe, but the head of an old ram, adorned with massive circling horns, won by dangerous mountain climbing and fair stalking, is a trophy of which any man may justly be proud.

It seems highly probable that the first wild sheep were developed in south-central Asia, in the region of the Altai Mountains, western Mongolia. At all events, the favorable conditions there obtaining have developed the great Siberian argali (*Ovis ammon*), whose enormous horns are a perpetual wonder to all who behold them. Near by in the Siar Mountains is found the Siar mountain-sheep. A comparatively short distance southward in Tibet is the Marco Polo sheep (*Ovis poli*), characterized by the enormous spread of its horns. A pair of horns of *Ovis poli* owned by Lord Roberts has a spread between tips of 54½ inches, and the longest horn measures 75 inches in length on the front curve. Southward of the range of the *Ovis poli*, in northern India, occurs the Punjab wild sheep, and the beautiful burrhel or blue sheep, both of them small species. Southwestward of Asia only two wild sheep are found, the small but handsomely colored mouflon of Corsica and Sardinia, and the large Barbary wild sheep or aoudad of the mountains of the Barbary states of north Africa. Northward from the home of *Ovis ammon* we find the Kamchatkan sheep, a species with horns like our white sheep, but otherwise exhibiting a strong resemblance to our big-horn. And this brings us to Bering Strait.

North America contains a really fine series of mountain-sheep species almost covering the mountainous regions of Alaska, and extending down the Rocky Mountain system to the region of Lake Santa Maria (lat. 30°) in northern Mexico. In addition to this, a species known as Nelson's mountain sheep branches off in southwestern Nevada, extends through southern California, and on down the peninsula of Lower California for two thirds of its length. The total area of North America inhabited by mountain sheep is about 3,500 miles long from north to south, and its greatest width from east to west, which is found in Alaska, is more than 1,000 miles. Of North American mountain-sheep, there are three conspicuous and well marked types, and three offshoots. When diagrammed in a manner calculated to appeal to the eyes they stand as follows:

TYPES	OFFSHOOTS
Big-Horn (*Ovis canadensis*)	Nelson's Sheep (*Ovis nelsoni*) Mexican Sheep (*Ovis mexicanus*)
Black Sheep	(*Ovis stonei*)
White Sheep (*Ovis dalli*)	Fannin's Sheep (*Ovis fannini*).

The Rocky Mountain big-horn (q.v.) has been known since 1803, and is our most widely known species. All the others are of recent appearance, only the white sheep dating back as far as 1884. The range of the big-horn extends from lat. 55° and lon. 120° to San Francisco Mountain, Arizona. It embraces the whole main range of the Rockies between those points, and also includes the Fraser River country, one locality in northern Washington, two in eastern Oregon, the counties of Custer and Dawson in Montana, the Black Hills and Bighorn Mountains of Wyoming, four localities in Utah, and the Grand Cañon of the Colorado.

This is the largest and heaviest species of our *Ovis*, and carries the most massive horns. It reaches its maximum development in the main range of the Rocky Mountains in western Alberta. A large ram stands 40 inches in height at the shoulders, and weighs about 325 pounds. Horns that measure 16 inches in basal circumference may justly be called very large. The largest and longest on record measured 18½ inches in basal circumference, and 52½ inches in length on outer curve, but the genuineness of this pair of horns is now doubted. One of the largest pairs in existence measures 16½ inches in basal circumference, 40½ inches in length, and weighs 38 pounds. Apparently the horns of a mountain-sheep grow as long as the wearer survives in a healthy condition.

Wild sheep are not covered with wool as domestic sheep are. Next to the skin is a coat of fine woolly hair, which is for warmth; but through this grows a coat of long, coarse hairs, large in diameter, pithy within and easily broken. This does duty as a rain-coat, and it also gives the animal its distinctive color. In summer, or late spring, when the old pelage is shed, the new coat is only half an inch in length, and the wild sheep stands forth fully sheared by the hand of Nature. At that season, the skin is worthless as a trophy. Mountain-sheep are at their best in October, November and December, and should be hunted at no other time. The lambs are born in May, and usually there is but one at a birth. Owing to the practical impossibility of keeping mountain-sheep of any American species alive in captivity, any-

Digitized by Google

where east of the great plains until they reach full maturity, our members of the genus *Ovis* are but little known to the general public, and consequently are quite unappreciated at their true value.

The white mountain-sheep of Alaska was not introduced to the world until 1884. It inhabits nearly all the mountainous regions of Alaska except the Alaska Peninsula, the valley of the Kuskoquim and the lower valley of the Yukon. Until recently it has been quite abundant on the Kenai Peninsula, and around the head of Cook Inlet. This animal is all over pure white, and its winter pelage is long and abundant. It is smaller than the big-horn, and its horns never exceed 15½ inches in circumference. Northward its range extends almost to the Arctic Ocean, and its southern limit is found at lat. 58°. In 1901, the New York Zoological Society sent a collector to Cook Inlet to capture newly-born lambs of this species, and bring them to New York, for acclimatization in the Zoological Park. Three lambs were captured, but they proved to be such delicate feeders that all died within a few days of their capture.

The black mountain-sheep was discovered in 1896 in northern British Columbia, and good representatives of this species are to be seen in the museums of New York, Chicago and Washington. The size of the black sheep is the same as that of *Ovis dalli*. The species is characterized by the wide spread of its horns, and the very dark color of its pelage, all except the white of the rump-patch and the abdomen. So far as known up to 1904, the range of this species is very circumscribed, for it has not been reported outside of a small area in northern British Columbia.

Fannin's mountain-sheep, often called the "saddle-backed sheep," was discovered on the Klondike River near Dawson City in 1900. It is an offshoot of the white sheep, and may possibly be the result of cross-breeding between that species and the black sheep. Its back, sides, and tail are bluish gray, and a brown band extends down the front of each leg; but all other parts of the animal are pure white. Its horns are like those of the white sheep. But little is known of the range of this species.

The Mexican sheep and Nelson's sheep are both offshoots of the big-horn. They are short-haired and large-horned, and their prevailing color is pale salmon gray.

Wherever they are not fully protected by law, all species of American mountain-sheep are being diligently sought for and killed, by hunters for sport, and by natives for food. The total number now remaining is very small, and it is impossible for the survivors to be protected too rigidly. The big-horn quickly learns the value of protection, and the herd in the Yellowstone Park is now so tame that it sometimes permits visitors to approach within thirty paces. It is a pleasure to add that this herd is rapidly increasing. WILLIAM T. HORNADAY, *Director New York Zoological Park.*

Sheep Tick or Louse. See SHEEP.

Sheep-eaters. See SHOSHONEAN INDIANS.

Sheepshead, the name of a fish (*Archosargus probatocephalus*) of the family *Sparidæ*. It is a stout, deep-bodied fish, with seven or eight vertical dark bands, and may attain a length of 2½ feet. It receives its name from the resemblance of its teeth to those of a sheep, having incisor-like ones in the front of the mouth and molars behind. It is found along the coast from Cape Cod to Texas, and is abundant locally and especially southward wherever the conditions are favorable. Like the drumfish, the sheepshead feeds chiefly upon hard-shelled mollusks and crustaceans, and large numbers congregate where such food is plentiful and often prove destructive to oyster-beds. For boiling and similar methods of cooking it is considered superior to any fish in our waters, and consequently has a considerable commercial importance. The sheepshead is also a great favorite with anglers, many of whom are attracted to Florida fishing grounds in its pursuit. They are captured on extra stout lines and hooks baited with clam or soft-shelled crab and usually make a gallant fight before being finally landed in the boat. The fresh-water drumfish (q.v.) is also called sheepshead.

Sheepshead Bay. See HORSE-RACING.

Sheepswool. See SPONGES.

Sheerness, shēr-nĕs', England, a seaport and garrison town in the county of Kent, on the Medway River where it joins the Thames, 35 miles southeast of London. It is strongly fortified and has an excellent harbor. There are spacious dock-yards, used for making repairs, and which employ 1,600 hands. The barracks accommodate several thousand soldiers and sailors. Sheerness-on-Sea is the modern town bordering the shore; the other divisions are Marinetown (a summer, bathing resort), Miletown, and Bankstown. Sheerness has a fine beach, broad esplanades, and splendid bathing and boating.

Sheers, an engine used for hoisting masts and spars in ship-building and rigging. It consists of two or more poles or spars fastened together near the top and having their lower ends apart, somewhat in the shape of a narrow A. The apparatus is raised on a slant and is steadied by guy ropes, the base being fastened to the dock or ship on which it is used. From the top depends the tackle necessary for hoisting. Sheers are used on ships, docks, and about shipyards for lifting heavy weights, guns, boilers or other machinery, spars and masts. When a mast is to be stepped or to be taken out, the sheers are mounted straddling the ship with the two base ends lashed to the deck on either side and the whole structure slanting so that its top is over the mast to be lifted or over the place into which it is to be dropped. Sheers used to be mounted on an old hulk or a ship cut down at one side so as to receive them; such vessels were called sheer hulks. They are little used in modern ship-building, their work being performed by permanent sheers on the docks or by the electrical cranes in the ship yards.

Sheet, generally speaking, a broad, flat, surface; specifically a large stretch of water or ice; a large flat portion of some substance whose thickness is insignificant compared to its length and breadth, as a sheet of metal, of cardboard, etc.; a large rectangular piece of linen or like material used to cover the body during sleep, and thus a portion of the furniture of a bed; as applied to stationery, a large piece of paper

Digitized by Google

either folded or unfolded; nautical, a sail, also, the rope attached to the clew of a sail. There are some substances to which the name sheet is not applied. Thus we speak of a board and not of a sheet of wood, no matter how broad, flat, and thin it is; so we do not speak of a level field as a sheet of ground, although we would speak of a pond in the field as a sheet of water; neither do we say a sheet of glass (except rarely) but a pane. The compound sheet-glass, however, is commonly used. As applied to paper sheets follow two nomenclatures. Blank sheets of the stationers' trade are known by arbitrary names given to certain sizes, such as cap, legal cap, royal, demi-royal. But printed sheets are denoted, as to size, by an ancient system of Latin nomenclature, based on the number of folds required to bring to that size a sheet of certain dimensions. Thus a quarto is a sheet made of four folds, an octavo of eight, a duodecimo of twelve, etc. (See BOOK.) From this idea of a folded, printed piece of paper a newspaper is often called a sheet, so, also, the leaves of books before bound, when the book is said to be "in sheets." A sail is called a sheet because it is made from a sheet of canvas and because it is broad, flat, and thin. The rope called a sheet (abbreviated from sheet-rope) is used to hold a sail tight, extended against the wind, or to haul it around and change its position. This sheet is sometimes a chain.

Sheffield, shĕf'ēld, **Joseph Earle**, American merchant and philanthropist: b. Southport, Conn., 19 June 1793; d. New Haven, Conn., 16 Feb. 1882. In 1813 he became a partner in a New York mercantile house, but subsequently removed to Mobile, Ala., where he acquired large interests in the cotton trade. From 1835 he was resident at New Haven, where he helped to obtain the charter for the New York and New Haven railway, visiting London to secure the co-operation of capitalists. He also built the Chicago and Rock Island line. By his gifts and bequests of more than $950,000 the scientific department of Yale, since known as the Sheffield school, was reorganized and enlarged. See YALE UNIVERSITY.

Sheffield, Ala., city in Colbert County; on the Tennessee River, and on the Louisville & Nashville and the Southern R.R.'s; about two miles west of Tuscumbia (q.v.), the county-seat, and opposite Florence. Sheffield is one of the new cities of the South, founded in 1884 as a result of the great manufacturing movement. It is in an agricultural region in which there are large deposits of iron ore. There are five large blast furnaces, machine shops, cotton gins, cotton compresses, and a grist-mill. There are eight churches, a high school, public graded schools, and several private schools. Pop. (1910) 3,400.

Sheffield, England, in the county of York, West Riding, at the junction of the Sheaf and the Don rivers, on several slopes surrounded by wooded hills. The suburbs are attractively built with many terraces and elegant residences. There is a great number of churches, chief of which is the parish church erected under the reign of Henry I., which contains some interesting monuments; St. Paul's, a good specimen of the Grecian; St. James'; St. George's; St. Philip's, and St. Mary's, having exterior ornamentations of gargoyles, etc., and a graceful interior with a lofty and richly groined roof. The other buildings include the town-hall, council hall and municipal offices, corn exchange, Norfolk market, Theatre Royal, Athenæum, libraries, association halls, Mechanics' Institute, Albert Hall, Music Hall, and various others. The barracks are surrounded by extensive grounds. There are numerous hospitals and several monuments. Of educational and literary institutions the principal are: Firth College; Wesley Ranmoor Methodist and People's College; grammar-school, public schools, art school, technical school; literary and philosophical institutions and museums. The town enjoys all modern improvements. There are extensive botanical gardens. The Sheffield cutlery is celebrated, and all its manufactures of steel are famous, including heavy steel branches, such as armor plates, rail, large castings for engines, steel for rifles, etc. The other industries include the manufacture of optical instruments, iron and brass foundries, various mills, etc., besides silver plating, bicycles, cabinet-work, tanning, etc. Sheffield was in early times a Roman station, and was an incorporated town under the Anglo-Saxons. In the 14th century it was already noted for its cutlery. Its history is also connected with the persecutions in the Netherlands, having been the refuge of victims suffering persecution under the Duke of Alva, who introduced their mechanical skill into the country. It developed rapidly in the 19th century, and became one of the greatest manufacturing cities of England.

Sheffield Scientific School, a department of Yale University. See YALE UNIVERSITY.

Sheik, shēk, an Arabic word signifying an aged man or elder, is used generally as a title of reverence, and has come to acquire a great variety of significations. Among the Bedouins and other migratory tribes where patriarchal government prevails, the head of every tribe is called a sheik. The superiors of the Mohammedan religious or monastic orders are called sheiks. The chief mufti is called sheik-ul-islam. In general the title is given to learned men, and by a wider extension is used as a common title of courtesy, like Mr.

Sheil, shēl, **Richard Lalor**, Irish orator, dramatist and politician: b. Drumdowney 17 Aug. 1791; d. Florence, Italy, 25 May 1851. He was educated at Stonyhurst College and Trinity College, Dublin, studied law at Lincoln's Inn and was called to the bar in 1814. His progress in his practice was slow and he turned to dramatic writing, having already produced a moderately successful drama, 'Adelaide' (1814). A tragedy, 'The Apostate,' was produced in 1817, and ran through the season. He produced 'Bellamira, or the Fall of Tunis' (1818); 'Evadne' (1819); 'The Huguenot' (1822), and with John Banim, 'Damon and Pythias.' Of these 'Evadne' is considered the best. He next joined with Curran in contributing to the 'New Monthly Magazine' the 'Sketches of the Irish Bar.' In 1825 he visited London with O'Connell, O'Gorman and others to protest against the bill that had been introduced for the suppression of the Catholic Association, and during the progress of the agitation continuing until 1829 spoke many times in public meetings

Digitized by Google

in Ireland in behalf of the Irish cause. When emancipation was finally secured, Sheil moved the dissolution of the Catholic Association. In 1830 he entered Parliament from Milborne Port in Dorset, sat for County Louth in 1831, and in 1833 was member of the first reformed parliament for County Tipperary. He gradually withdrew from a close identification with the Irish cause and turned his attention more to the foreign policies of the empire. Shortly after the accession of William IV. he became commissioner of Greenwich Hospital, but later exchanged this post for the vice-presidency of the board of trade. In 1846 he was appointed master of the mint and his inability to move in the relief of the famine in Ireland, though not thoroughly understood in that country, yet diminished his popularity. His last appointment was that of minister to the court of Tuscany in 1850. He was brilliant in parliamentary speaking, though he lacked spontaneousness, and carefully prepared each address. Of his forensic speeches that delivered as counsel for John O'Connell at the «monster trials» in Dublin in 1844 is accounted his best.

Shek'el, a unit of weight supposed to have been first used in Babylonia, and afterward by the Jews and other peoples; also a coin used by the Jews and thought to have been introduced by Simon Maccabæus. The weight was reckoned as one sixtieth part of a maneh, and afterward was revised by the Phœnicians to be one fiftieth part of a maneh (then called mina). It is probable that the shekel, with other measures of weight, underwent much revision as to size, shape and weight. Phœnician shekels are found in the following weights: 234 grains (Troy), 224 grains, 218 grains, 208 grains. The Assyrian shekel was of 129 grains; their double shekel of 258 grains. The Jewish shekel was of 218 grains.

The use of the shekel as money among the ancient Hebrews is popularly supposed to date with Simon Maccabæus, to whom was given (1 Mac. xv. 5) the power «to coin money for thy country with thine own stamp.» Whether or not Simon made use of this privilege is disputed by some authorities, but it is generally conceded that either he or his son coined the first native Hebrew money. This was about 141 B.C. The shekel seems to have been of gold, copper, or silver, and originally of a shekel in weight. The gold shekel was worth about $5.69, the copper about three cents, and the silver shekel about 54 cents. The silver shekel seems to have been the most used. A common example of it shows on one side a pot of manna, or sacred bread, with the legend «shekel of Israel»; on the reverse a flower figure, supposed to have been a representation of Aaron's rod budding, and the legend «Jerusalem the holy.» The shekel of the sanctuary (Ex. xxx. 13) or temple tax was supposed, for a long period, to have been a special coinage, but it is now believed to have been the silver shekel of the country.

Shekinah, shē-kī'nạ, literally «residence», that is, of God, his visible presence as manifested in a cloud of radiance hovering over the mercy seat of the tabernacle, and in the temple of Solomon between the cherubim. The word is not found in the Bible but occurs frequently in the paraphrases of the Targum. Thus where we find in Exodus xxv. 8, «Let them make me a sanctuary that I may dwell among them»; the Targum of Onkelos has «I will make my Shechinah to dwell,» etc.

The Jews reckoned the Shekinah among the marks of divine favor which were wanting to the second Temple, but expected its return on the appearance of the Messiah. It was the Shekinah which led the children of Israel as a pillar of fire. See Exodus xix. 9. In the New Testament the Shekinah is referred to, Luke ii. 5; John i. 14; etc. Consult: Lowman, 'On the Shechinah'; Taylor, 'Letters of Ben-Mordecai'; Upham, 'On the Logos.'

Shelburne, shĕl'bėrn, **William Petty, Lord,** 1st Marquis of Lansdowne: b. Dublin 20 May 1737; d. London 7 May 1805. He entered Oxford, but two years later left the university and entered the army. While engaged in the campaign in Germany he was returned to the House of Commons for High Wycombe in 1760, and was re-elected in the following year. He was also elected to the Irish parliament, but he never sat in either body, for the death of his father in 1761 elevated him to the House of Lords. He was frequently employed by Bute as a negotiator in political combinations and on 20 April 1763 he became president of the board of trade and foreign plantations with a seat in the cabinet; but his speech in the debate on the proceedings against Wilkes caused his dismissal from his staff appointment. In April 1764 he took his seat in the Irish House of Lords as Earl of Shelburne, and in 1766 took a leading part in the English parliament in the repeal of the Stamp Act. Under Pitt he became secretary of state for the southern department (23 July 1766), and in the following month the entire control of the administration of the colonies was placed in his hands. He endeavored to pursue a conciliatory policy toward the American colonies, but in this was thwarted by his colleagues, and in January 1768 was superseded by Lord Hillsborough. He stood alone with Chatham against coercing the American colonies, but his opposition was unavailing. In his parliamentary speeches, many of which became famous, he always opposed the coercive measures of Lord North's ministry, recommended measures for ending the hostilities in America, but declared he would never consent to the acknowledgment of American independence. When Lord North resigned in March 1782 Shelburne declined the king's invitation to form a new ministry, but acted as intermediary in pressing the post upon Rockingham. In the cabinet formed by the latter, he became secretary of state for home affairs, and tried to introduce several economic reforms. Rockingham's death occurred in July of that year and Shelburne accepted the duty of forming a government. In this ministry William Pitt, then only 23, became chancellor of the exchequer. In the debate on the change of ministry Shelburne declared that he still adhered to all the constitutional ideas that he had imbibed from his master in politics, Lord Chatham, and that he had not altered his opinion concerning American independence; but during the negotiations of the Peace of Paris he was reluctantly led to agree to the concession. The coalition of North and Fox against his government led to his resignation 24 Feb. 1783.

Digitized by Google

In December 1784 he became Marquis of Lansdowne in the English peerage. He was one of the best hated men of his time, a circumstance probably due to his independent spirit in party politics and his supercilious manners. Yet many of his views were more enlightened than his times. He advocated parliamentary and economic reform, Catholic emancipation and religious equality, and free trade. Disraeli said he was «the first great minister who comprehended the rising importance of the middle class.» He patronized literature and the fine arts, and his later years were largely devoted to his collection of books and pictures. Consult Fitzgerald, 'Fitzmaurice, Life of William, Earl of Shelburne' (1875-6).

Shelburne, Canada, capital of Shelburne County, Nova Scotia, a seaport town on the southwest coast at the head of a deep and capacious bay, forming one of the safest harbors of the province, 160 miles southwest of Halifax. Shelburne is a terminus of the intercolonial railway system, and has an important maritime and transit trade. Ship-repairing docks and ironworks are the chief industrial establishments; and its fisheries are valuable. The Roseway River supplies abundant water power. The entrance to the harbor is marked by a lighthouse on McNutt's island; it exhibits two lights, the highest 120 feet above the sea. After the American Revolution the population of Shelburne was increased to about 12,000 by the advent of United Empire loyalists. It has since declined in importance.

Shel'by, Isaac, American soldier: b. North Mountain, Md., 11 Dec. 1750; d. Traveller's Rest, Lincoln County, Ky., 18 July 1826. He became a surveyor and in 1771 removed to Tennessee. In 1774 he was appointed lieutenant in the company of his father, General Evan Shelby, fought at the battle of Point Pleasant, and remained in command of the fort there until 1775. He was engaged at the battle of Long Island flats where his valor won the day, became commissary of the frontier in 1777 with rank as captain, in the succeeding year was promoted colonel, and also served as a member of the Virginia house of delegates in that year. He planned the important action at King's Mountain in 1780, served under Marion in 1781 and under Greene in 1781-2, and was a member of the North Carolina legislature in those years. He was a member of the constitutional convention in 1791, and was elected the first governor of Kentucky in 1792, served until 1796, and again in 1812-16. He recruited and led 4,000 men to the relief of General Harrison in Canada in the War of 1812, receiving a gold medal from Congress for his services. He declined the office of secretary of war in 1817, and afterward lived in retirement, though he acted as commissioner with General Jackson in negotiating the treaty with the Chickasaw Indians in 1818. Nine counties in the Southern and Western States are named in his honor, as is also a college at Shelbyville, Ky.

Shel'byville, Ill., city, capital of Shelby County; on the Kaskaskia River, and on the Cleveland, C. C. & St. L., and the Chicago & E. I. R.R.'s; about 15 miles southeast of Springfield and 33 miles south by east of Decatur. It is in a fertile agricultural region in which considerable attention is given to stock-raising, lumbering, and coal-mining. The chief manufacturing establishments are flour mills, foundry, lumber mills, agricultural implement works, a woolen mill, and creameries. There is considerable trade in farm and dairy products, live stock, and coal. The one national bank has a capital of $75,000. Pop. (1910) 3,708.

Shelbyville, Ind., city, county-seat of Shelby County; on the Big Blue River, and on the Cleveland, C. C. & St. L., and the Pittsburg, C. C. & St. L. R.R.'s; about 26 miles southeast of Indianapolis, and 90 miles north of Louisville, Ky. It is in an agricultural and stock-raising region. The chief manufacturing establishments are flour mills, creameries, barrel factories, lumber and planing mills, ice factories, wagon and carriage works, and a furniture factory. It is the commercial and industrial centre for a large part of Shelby County, and has considerable trade in farm and dairy products, live stock, and manufactures. There are 12 churches, five public schools and one parish school, and a public library. The two national banks have a combined capital of $200,000; there are several building and loan associations and one private bank. The city has had a steady growth, mainly due to the general development of the surrounding country. Pop. (1910) 9,500.

Shelbyville, Ky., city, county-seat of Shelby County; on the Southern and the Louisville & Nashville R.R.'s; about 28 miles east of Louisville and 21 miles west of Frankfort. It is in an agricultural and stock-raising region. Large quantities of tobacco, in the vicinity, are prepared for market and shipped from Shelbyville. It has a flour mill, creameries, machine shops, and cigar factories. The educational institutions are a high school, elementary schools, Science Hall School (M. E. South), opened in 1825, Stuart Female College, founded in 1839, Shelbyville Academy for Boys, opened in 1881. The three state banks have a combined capital of $100,000. The government is vested in a mayor and a common council. Pop. (1910) 3,412.

Shelbyville, Tenn., town, county-seat of Bedford County; on the Duck River, and on the Nashville, Chattanooga & Saint Louis railroad; about 65 miles south by east of Nashville. In June 1863 the town was the scene of military operations, and during the greater part of the Civil War, Shelbyville and vicinity were scenes of many skirmishes. It is in an agricultural and lumbering region, and in the vicinity are several varieties of good building stone. The chief manufacturing establishments are foundries, machine shops, lumber and planing mills, a large lead-pencil factory, cotton and woolen mills, and a flour mill. The chief products shipped are pencil-cedar, telegraph and telephone poles, grain, and mules. There are six churches, graded public schools, and the Shelbyville Female College, founded in 1853. The two banks have a combined capital of $128,000. Pop. (1910) 2,869.

Sheld-drake, or **Sheldrake,** a sea-duck (*Tadorna cornuta*) of the cooler parts of the Old World, which frequents sandy shores and makes its nest in burrows in sand-dunes, earthen cliffs, old rabbit-warrens, etc. It is of large

Digitized by Google

size and very handsome plumage, and in the Frisian islands and some other parts of the world the people provide it with acceptable artificial breeding-burrows, and take a portion of its eggs and down, so making an annual profit from the arrangement. Several other species of the same genus are found throughout Africa, south-eastern Asia and Malaya, one of which is well-known in India as the Brahming duck. Much ornithological interest attaches to these birds, and the name itself is a matter of curious speculation, for which see Newton, 'Dictionary of Birds' (New York 1896).

Sheldon, Charles Monroe, American Congregational clergyman and author: b. Wellsville, N. Y., 26 Feb. 1857. He was graduated from Brown University in 1883, from the Andover Theological Seminary in 1886, was ordained in 1886 to the Congregational ministry, and in 1889 became pastor of the Central Congregational Church of Topeka, Kan. In 1900 he attracted considerable attention by his connection with the Topeka 'Capital,' of which he took entire charge for one week, and which he published as a distinctively Christian daily after principles enunciated in his book, 'In His Steps' (1896), a work of excellent intention, but no literary importance, which was sold very extensively. Among other volumes by him are: 'Robert Hardy's Seven Days' (1892); 'Malcolm Kirk' (1897); 'The Wheels of the Machine' (1901); 'The Narrow Gate' (1902); 'The Heart of the World' (1904).

Shel'don, Lionel Allen, American soldier, lawyer and administrator: b. Otsego County, N. Y., 30 Aug. 1831. After studying at Oberlin College he was admitted to the bar in 1851; and began practice in Elyria, Ohio. In 1856 he was a delegate to the Philadelphia Republican Convention and there supported John C. Frémont as its nominee for President. In 1861 he was commissioned a brigadier-general of militia, and in that capacity raised many recruits for the Union army. He was made colonel of the 42d Ohio Infantry in 1862; won distinction in the battles of Chickasaw Bayou and Arkansas Post; and took part in the capture of Vicksburg. He was brevetted brigadier-general of volunteers in 1865. After the war he removed to New Orleans, where he practised law; was a Republican member of Congress in 1869–75; and governor of New Mexico in 1881–5.

Shel'iff River (French *Chéliff,* shālēf), Algeria, a river rising on the Atlas Range and flowing north into the Mediterranean Sea, which it enters near Mostaganem. It traverses the great central plateau, and then flows for a considerable distance westward, parallel with the coast, through a fertile longitudinal valley between the two coast ranges. It is 400 miles long, and the largest river in the colony.

Shell, the external limy, chitinous or silicious integument or covering of such invertebrate animals as form a hard exoskeleton; or some structure resembling the armor of a mollusk. Thus, broadly, the term applies to the protective envelope of eggs; the tests of foraminifers, polyzoans and echinoderms, the living-tubes of annelids, the exoskeletal integuments of the crustaceans, the shards of beetles, and the egg-pouches and cuttle-bone of the argonauts and calamaries, as well as to the hard armor, or "shell" proper, brachiopods of mussels and snails. Whatever its form or homology, it serves the purposes of support and protection. The characteristic structure of the exoskeleton, tests and other "shells" of the invertebrates mentioned above are given in the articles on FORAMINIFERA, ECHINODERMATA, etc.; and the present treatise may be restricted to the shells of the *Mollusca.*

The shells of mollusks vary from entire absence, or a merely rudimentary condition, to highly elaborate and ornamental examples; and from almost microscopic minuteness and delicacy to massive structures completely enveloping and protecting the animal and weighing several hundred pounds. All are composed mainly of carbonate of lime, which in some cases, as the hard shells of the cameo-strombs, amounts to 99 per cent, while in others as much as 10 per cent may consist of other earthy salts, and a small amount of organic material called "conchiolin," which disappears as shells dry out after the death of their occupants. Various views have been held as to the formation of the shell, but it is plain that the mantle-margin is the principal agent in its deposition; accidental holes and breaks will be repaired elsewhere, and even the foot may secrete shelly matter, but regularly this is the function of the epithelial cells along the edge of the mantle, to separate the carbonate of lime from the blood and throw it out, where it crystallizes and cements itself into the required form as it exudes. This deposition is not continuous, but takes place at more or less regular periods or seasons, annually or semi-annually, alternating with seasons of rest. The additions to the shell made during each period of activity are often indicated by a thickened line forming a raised and more or less knobbed or irregular ridge, called a varix. "The various details of sculpture on the exterior surface of the shell,— the striæ, knobs, nodules, imbrications, spines and other forms of ornamentation are all the product of similar and corresponding irregularities in the mantle margin, and have all been originally situated on the lip. Spines, for example, those of *Murex* and *Pterocerus,* are first formed as a hollow thorn, cleft down its lower side, and are afterward filled in with solid matter as the mantle-edge withdraws. What purpose is served by the extreme elaboration of these spiny processes in some cases, can hardly be considered as satisfactorily ascertained. Possibly they are a form of sculptural development which is, in the main, protective, and secures to its owners immunity from the attacks of predatory fishes." (Cooke, 'Mollusca,' p. 256.)

Three principal varieties of texture are perceptible in molluscan shells. The porcellanous shells of gasteropods consist of three layers, which consist of thin plates, placed side by side, the direction of the planes of these laminæ being different in the different layers. Thus the plates may lie transversely in the central layer and horizontally in the others, or longitudinally in the middle and crosswise in the outer and inner layers. The nacreous shells form the second variety made up of numerous closely-packed layers, the edges of which exhibit undulations of their surfaces. The lustre and prismatic hues of nacre are due to the minute striæ on the surface which break up and refract the

Digitized by Google

light. (See PEARL.) It is interesting to note that the nacreous type of shell occurs largely among mollusks which now represent very ancient forms. The fibrous shells are composed simply of successive laminæ or layers of prismatic cells. In their living state shells are covered externally by a layer of animal matter, known as the periostracum, or epidermis, well seen in the fresh-water mussels, for example. This layer may, however, be so delicate as to be almost invisible to ordinary observation. The colors of shells are due to pigment deposited in the course of their growth from pigment cells situated along the mantle-margin. When the valves or pieces of which a shell is composed are equal in size the shell is denominated equivalve; if more developed to one side of the middle line than to the other it is termed inequilateral. The prominent point of the shell is the umbo or beak; this always points in the direction of the mouth, and hence the part on which the mouth is situated is termed anterior; the opposite posterior. The part where the hinge is situated, is the dorsal or upper border; the border opposite to this or that by which the shell opens, the ventral side or base. The length of a bivalve shell is measured from its anterior to its posterior margin; and its breadth from the dorsal to the ventral border. The shells of bivalved mollusks (pelecypods) are shut or drawn together by the action of either one or two adductor muscles. The impressions or «scars» of these muscles may generally be perceived on the interior of the shells, but in some cases (as in oysters) only a single adductor muscle is developed, this latter representing the posterior muscle of those forms possessing two. The forms with single muscles are named *Monomyaria*, those with two being termed *Dimyaria*. These shells are opened not by muscular action but by that of ligaments situated at the hinge, one of which (the external ligament) is put on the stretch when the shell is closed, and opens the shell in virtue of its elasticity. The internal ligament is situated within the hinge, and usually in pits or depressions of the shell. This latter is also compressed when the shell is closed, and aids in opening the shell by its elasticity. The hinge may be curved or straight, and may exhibit sets of teeth springing from one valve and fitting into sockets on the opposite valve of the shell.

In gasteropods the shell is typically a spiral univalve; and we may conceive of a simple conical shell (such as that of the limpet) being converted into a spiral form by supposing it to be first long drawn out, and then twisted upon itself from above downward, either to the right or left side. The apex of the gasteropod shell is usually more or less oblique in position. The coils or whorls of the spiral shell may either be separated (as in *Vermetus*) or contiguous, and in close contact. Sometimes the whorls lie in one and the same plane, being coiled round a central axis (as in the fresh-water *Planorbis*), and then the shell is named discoidal. But generally the gasteropod shell shows the whorls to be wound in an oblique manner, so as to form a true spiral, and shells with this conformation may therefore be named trochoid, turreted, turbinate, etc. An ordinary gasteropod (or snail) shell shows the whorls wound round a central axis or columella; the nucleus or apex being formed by the shell of embryonic life, and the largest or terminal whorl (body whorl) showing the mouth or aperture, which may exhibit various dentations of its margins. When the columella or axis of the shell is hollowed, and opens below at the mouth-aperture, the opening is named the umbilicus; but it may also be solid and imperforate. If the aperture or mouth of the shell is notched for the passage of one or more siphons, the shell is said to be siphonostomatous. If, on the contrary, its margin is unbroken and entire, the shell is holostomatous.

The shells of *Pteropoda* are generally of delicate glassy structure, and consist either of a dorsal and ventral or united plate, or of a spiral shell. In some extinct forms (for example, *Conularia*) of Pteropoda the shell was of large size, and of quadrate shape.

The *Cephalopoda* or cuttlefishes possess (as in the *Tetrabranchiata*; see NAUTILUS) external many-chambered shells, or, as in ordinary cases, internal shells, which may be destitute of chambers, or chambered as in the extinct *Belemnites* or in the existing *Spirula*. In the argonaut (q.v.), the shell is external, but single-chambered; and is, moreover, not a true shell, but a foot-secretion of the female only, formed not by the mantle but by two of the feet or arms, which are specially expanded and modified for this office; and the office of which is the safety of the developing eggs.

Shell, Its Industrial Uses. It may surprise some to learn that shells rank among the principal «fishery» products of the world. This refers to those used for industrial purposes and not to the large supplies for museum and cabinet collections. In London the sales of pearl shells or mother-of-pearl, amount to about $4,000,000 each year, and the annual imports of this material into the United States exceed $1,000,000 in value. The shells caught in this country aggregate about 1,000,000 tons annually. The economic utilization of these is more diversified than is generally supposed, giving employment to many thousands of persons, and constantly increasing in importance. The most valuable item in shell production is mother-of-pearl. The most important is the pearl oyster found in many inshore tropical waters of both continents. The shells vary greatly in color and iridescence, but three general classes are recognized, namely, white or silver-lipped, yellow or golden-edged, and smoky or black-edged; the last yielding the so-called «smoked» mother-of-pearl.

The white shell has the silvery lining uniform over the surface, and as it may be cut up to greater advantage, it is the most valuable. When black pearl buttons are fashionable, the black-edged shell sells almost as high as the best white shell. A fair valuation of mother-of-pearl shells is $400 per ton, though the choicest sell for upward of $1,500 per ton.

During the last 10 years large quantities of low-grade pearl shell have been secured from the fresh-water mussels of the United States. These occur principally in the Mississippi River from Prairie du Chien, Wis., to Quincy, Ill., and to a much less extent in adjoining waters. Though their utilization originated so recently as 1891, the present annual product is very large, exceeding 20,000 tons during certain years. The value is much less than that of choice pearl shell, selling usually for less than $25 per ton.

Digitized by Google

Many univalve shells are sufficiently nacreous and iridescent to be used as mother-of-pearl, especially abalones, top shells, «green snail» shells, etc. In variety and intensity of coloring the pearly lamina of some of these exceeds that of the pearl oyster. However, the coloring is not so harmonious nor is the shell so thick and flat as in the pearl oyster, consequently they are not desirable for many purposes for which the latter are employed.

Mother-of-pearl is used in the manufacture of a great variety of articles for which it is peculiarly adapted by reason of its hardness and beauty. Most important of these are buttons, knife handles, parasol handles, buckles, penholders, pistol stocks, etc. It is also used for inlaying and for covering opera glasses, card cases, etc. In the aggregate a very large number of persons are given employment in working up this material. Formerly the business was centred at Birmingham, England, and Vienna, Austria, 4,000 persons being thus employed at the former place a few years ago; but it has gradually extended to other localities, especially in France and the United States. It is claimed that about 8,000 persons are employed in working pearl shell in Austria, 5,000 in England, 4,000 in France, 3,500 in America, and many in various other countries. The manufacture of pearl buttons in this country from domestic shells dates from 1891 and is already of very great extent, the 60 factories giving employment to about 2,500 persons and using 12,000 tons of shells annually, yielding about 600,000,000 buttons.

Pearl shell is much used for inlaying, especially of musical instruments, jewelry boxes, domestic furniture, church vestments, etc. Artistic work of this nature is done in the United States as well as in Europe and Asia. The shell is cut in simple patterns and is also used in floral and in arabesque designs. For this purpose the brilliantly colored abalone shell is used with beautiful effect, especially when combined with white shell. Some very elaborate work of this nature is done. A mandolin recently exhibited in this country contained more than 2,000 pieces of four different kinds of shell, and 225 days' work were expended in cutting and finishing the pieces, the whole representing an investment of $1,500. Some years ago there was exhibited in New York a piano, the entire keyboard of which was of pearl. The body of the keys was of ordinary white shell and the flats and sharps were of green abalone, the effect being extremely rich and pleasing.

The most abundant shells in America are those of oysters and clams, especially the former. The product of these approximates 30,000,000 bushels annually and the purposes to which they are applied are numerous. The most important use is in road-making. At various points on the Atlantic seaboard, and particularly in the Chesapeake and the Delaware bay regions, many miles of good roads have been made of this material. It is estimated that 3,000 miles of roads on the Atlantic coast have been surfaced with shells. Connecticut, Long Island, the Delaware bay side of New Jersey, Delaware, Maryland, Virginia, North Carolina and Louisiana contain many excellent examples of oyster shell roads. To cover a road 16 feet wide to a depth of 15 inches in the middle and 8 inches at the sides requires about 30,000 bushels of shells per mile, costing on an average of three cents per bushel, or a total of $900 per mile. To keep such a road in good repair requires about 2,500 bushels of shells per mile annually at a cost of about $75. Though they constitute the cheapest and most convenient material in the sections where they are commonly used, shells are not wholly satisfactory for road material owing to their rapid wear and the spreading of objectionable lime dust.

Oyster shells are largely employed as ballast for beds of railroads. While not nearly so durable or steady as rock, they answer the purpose fairly well and are the most convenient and economical material in many localities. Examples of their use for this purpose occur on many of the railroads in Maryland, Virginia, and Louisiana.

Oyster shells have been extensively used as a source of lime, especially for agricultural purposes, as well as in masonry. Most of the brick buildings erected in colonial times were solidified with shell lime. Owing to its tendency to absorb moisture and thus make the houses damp its use for this purpose was abandoned soon after the discovery of limestone in abundance. The quantity of burned oyster shells spread on farming lands amounts to many thousands of tons annually. These shells are also crushed into small particles and fed to chickens to improve their digestion and their egg laying. This use is increasing in popularity. Oyster shells are also employed in the manufacture of certain special grades of steel owing to their large content of carbon.

A somewhat recent use for shells in America is for spreading on private oyster grounds for the purpose of obtaining a «set» of young oysters. When the extremely small oysters hatch from the floating eggs and sink to the bottom it is important that they find a clean substance for attachment, otherwise they are readily smothered. It is estimated that 4,000,000 bushels of oyster shells are used annually for this purpose, mostly in the waters of New York, Connecticut, and Virginia. They are spread immediately before the spawning season, usually in June in the Chesapeake region and in July in Long Island Sound.

Several other varieties of shells are used for «spat collecting,» especially «jingles» (*Anomia ophippium*), «quarterdecks» (*Crepidula fornicata*) and scallops (*Pecten irradians*). These are obtained mostly from Peconic Bay at the east end of Long Island where several hundred thousand bushels of mixed shells are dredged annually to be marketed in the oyster planting regions of New York and Connecticut. They are considered superior to oyster shells for «clutch,» owing to the fact that they are smaller and only a few young oysters «set» on each, thus avoiding the crowding which occurs when large shells are used. Another reason for their preference is that they are easily broken and disintegrated and so do not encumber the ground after serving as «spat collectors.»

Large quantities of shells are used for ornamental purposes. Especially prominent among these are the abalone or ear shells obtained from California, Japan and various other countries. About 500 tons of abalone shells are gathered annually on the Pacific coast of America, worth about $40,000. This product, however, is only one fourth or one third as large as it was 20

Digitized by Google

years ago. When cleaned and polished the highly iridescent green, red and pearly white colors are exquisite and make these shells beautifully ornamental. Much skill is exercised in polishing in order to produce the best effects. Some of the abalone shells are of such shape and coloring that it is possible in grinding to produce a perfect cross of black against a pearly white background; these meet with ready sale, the purchasers usually assuming that the cross appeared on the shell in nature.

The large green conch or fountain shell obtained on the Florida coast, the West Indies, etc., is much used for ornament. The graceful curves and the delicate tints of lovely pink color make it one of the most attractive of all shells. It is much used in making brooches, earrings, etc., and in the form of beads in imitation of pink coral and pink pearls. Large quantities of conches have been pulverized and used in porcelain manufacture.

The pectens or scallop shells have long been admired owing to their beauty of form. During the Middle Ages pilgrims ornamented their clothing with them, as an indication, doubtless, of having crossed the sea to the Holy Shrine in Palestine, and for this reason they were known as "pilgrim shells." To commemorate that event they were preserved in the heraldic devices of many families whose ancestors had performed that journey. Scallop shells were formerly much used by cooks for holding foods, hence the name "scalloped oysters."

The popularity of shells for personal ornamentation has resulted in their use as currency or standard of value among many primitive peoples. A well-known example of this is the wampum of the North American aborigines, made from the quahog or hard clam shell, so numerous on the Atlantic coast. Somewhat less extensive was the use of the tooth shell or *Dentalium* on the northwest coast, and of the abalone on the California coast. Even at the present time in many parts of Africa and to a less extent in British India species of the cowry family are used as currency. In some seasons 8 or 10 vessels carry cargoes of the money cowry (*Cyprea moneta*) to the west coast of Africa, where they are exchanged for palm oil and other products.

The window-glass shell (*Placuna placenta*), found in the Pacific and Indian oceans, and especially among the Philippine Islands, has an almost flat bivalve shell, six or eight inches in length. The inside of this shell is glazed over and has a subdued pearly lustre. It is so thin and transparent that print can be read through it, and it is used as a substitute for glass in windows, admitting a soft, mellow light into the room. It is commonly used in the Philippines in windows of residences, etc.

The giant clam (*Tridacna*) yields the largest and heaviest shells in existence, single pairs weighing over 500 pounds in some instances. These are much used for ornaments, especially for fountain basins and for benetiers or holy-water fonts. They are found in many tropical waters, and especially on the pearling grounds. Divers inadvertently placing a hand or a foot in the open shell are held imprisoned, and it is necessary for the unfortunate man to at once cut off the limb in order to save his life. In case both hands are imprisoned, as in head diving, escape is impossible without assistance, which usually arrives too late. A beautiful pair ot these shells are used as benetiers in the Church of Saint Sulpice in Paris. This pair is said to have been a gift of the republic of Venice to Francis I.

The most artistic use of shells is in the formation of cameos, which are cut from univalve shells made up of laminæ of different colors. The middle lamina, which is usually white, forms the body of the figure in bas-relief, and the dark inner layer forms the ground. The outer or superficial layer is entirely removed, or it may be used to give a varied appearance to the surface of the design.

Of the several varieties of shells employed in cameo cutting, the black helmet (*Cassis tuberosa*) is the most valuable. This occurs in the West Indies and to a less extent on the American coast south of Cape Hatteras. It has a blackish inner coat and the cameo cut from it shows white upon an onyx ground varying from dark claret to much lighter shades, producing effective results. This shell is ordinarily 12 inches in length, and usually five brooches of average size and several smaller articles may be cut from each one. The bull's mouth (*C. rufa*) is also popular; it has a red inner coat and a sardonyx ground. The horned helmet (*C. cornuta*) gives white upon an orange yellow background. The laminæ of this shell are apt to separate, making it disagreeable to work. The queen conch is also used to a considerable extent; the ground color is brilliant pink, which is somewhat evanescent on exposure to light. An attractive method of using this shell is to incise the bas-relief in the pink layer, using the white as the background, thus reversing the usual method.

Shell cameo figures consist of copies of antiques, original designs, and portraits. Sometimes an entire shell — especially of the black helmet variety — is used, and either a small figure is cut on the face of the shell or the entire surface is covered. In the latter case the principal design is in the centre and around it are such minor designs as the fancy of the artist dictates. Some of these sell very high, and hundreds and even thousands of dollars are secured for a single carved shell. One exhibited in this country by a Naples artist represented two years' work.

The real value of a cameo consists in purity of material, beauty of design and delicacy of workmanship. As an art, shell cameo cutting has become much degraded, having fallen under the deteriorating influences of low-priced productions. Most of the cutters at present are merely skilled workmen and not artists, and the bulk of the output consists of cheap productions quite inferior to those of half a century ago. For this reason the fashion for them has greatly declined. However, there are yet several shell cameo workers who compete with sculptors in artistic productions.

Charles H. Stevenson,
United States Fish Commissioner.

Shell. See Ordnance; Projectiles.

Shell Game. See Thimble Rig.

Shell-ibis, or **Shell** or **Snail Eater**, names for the open-bill (q.v.). It is not an ibis, but a stork, and feeds principally on snails and fresh-water mussels. See Open-bill.

Digitized by Google

Shell Money. See Wampum.

Shell-sand. Sand consisting in great part of fragments of shells comminuted by the beating of the waves (see Sand), and often containing a small proportion of organic matter. It is a very useful manure, particularly for clay soils, heavy loams, and newly-reclaimed bogs. It is also advantageously applied to any soil deficient in lime. It neutralizes the organic acids which abound in peat, and forms with them compounds which serve as food for plants. Great deposits of shell-sand are found on the coasts of Devonshire and Cornwall, and are of much value in the agriculture of that district. Shell-sand is also found on many other parts of the European coasts, and is much used as a manure in the maritime districts of France, especially Bretagne and Normandy. It abounds upon the coast of Florida and the Gulf of Mexico and in some places has been compacted and cemented into the rocky substance called coquina, and often used as a building-stone.

Shel'labarger, Samuel, American lawyer and politician: b. Clarke County, Ohio, 10 Dec. 1817; d. Washington, D. C., 6 Aug. 1896. He was graduated from Miami University, Oxford, Ohio, in 1842, and was admitted to the bar in 1847. In 1851 he was elected to the Ohio State legislature, and was a member of Congress in 1861-3, 1865-9, and 1871-3. In 1871 he introduced what was known as the «Ku Klux Law.» In 1869-71 he was minister to Portugal, and after his last term in Congress he was appointed a member of the Civil Service Commission, but devoted himself to the practice of law in Washington.

Shelley, shĕl'ĭ, **Harry Rowe,** American organist: b. Connecticut 8 June 1858. He studied music at Yale under Professor Stoeckel and afterwards under Dudley Buck. After completing his musical education in Paris and London, he began his career as professional church organist and since 1899 has been engaged at the Fifth Avenue Baptist Church, New York. He has composed many songs, anthems, and organ pieces, and his sustained compositions include two sacred cantatas; a lyric music drama 'Romeo and Juliet'; a lyrical intermezzo, 'Santa Claus'; and a 'Symphony in E major.'

Shelley, Mary Wollstonecraft Godwin, English writer: b. London 30 Aug. 1797; d. there 21 Feb. 1857. She was the daughter of William Godwin and Mary Wollstonecraft. In 1814 she eloped with the poet Shelley to Switzerland, and after the death of his wife, Harriet Westbrooke, was married to him. While traveling with him she composed her famous romance of 'Frankenstein' (1818), which excited an immense sensation. After her husband's death she devoted herself much to literary work, producing 'Valperga' (1823); 'The Last Man' (1826); 'Lodore' (1835); 'Falkner' (1837); and other works of fiction; several biographies for the Cabinet Cyclopædia; 'Journal of a Six Weeks' Tour,' with Shelley 1814; 'Rambles in Germany and Italy' (1844); and an edition of Shelley's poetical works and miscellaneous writings.

Shelley, Percy Bysshe, English poet: b. Field Place, near Horsham, Sussex, 4 Aug. 1792; d. by drowning in the Bay of Spezzia, on or after 8 July 1822. He was the eldest son of Timothy, afterward Sir Timothy, Shelley, a not over-intelligent country gentleman, and grandson of Sir Bysshe Shelley, who was something of an adventurer, handsome, clever, and graceless. His mother, Elizabeth Pilford, seems to have handed on to him her beauty and her fondness for writing. After some tutoring he was sent to Sion House Academy, at Brentford, a middle class school, where his shyness and delicacy exposed him to brutal bullying. His biographers seem right in dating from this period his hatred of tyranny and resistance to all forms of oppression. He seems also to have developed his faculty for musing, for scientific speculation, and for wide reading, especially at this time in the wild romances of Mrs. Radcliffe and others of her class. On 29 July 1804 he entered Eton where he remained for five years, developing along the lines just described. His tutors were not calculated to inspire his respect and thus could do little or nothing to check his extravagant and abnormal tendencies; nor could the outrageous fagging to which he was subjected fail to be deleterious to so sensitive an organization as his. He was nicknamed «Mad Shelley,» lived as much apart as he could, dabbled in chemistry, haunted romantic spots, read widely — acquiring a taste for the classics, — and found some consolation in the society of Dr. James Lind (later represented as the hermit in 'The Revolt of Islam' and as Zonaras in 'Prince Athanase'), an elderly physician of scientific and eccentric tastes, who was apparently more sympathetic than discreet in his relations with a youth in need of guidance. As was natural, the precocious boy soon began writing and before he was seventeen had composed a Radcliffian romance, 'Zastrozzi,' as well as some immature poetry — e. g., parts of the 'Wandering Jew' written in conjunction with his cousin and future biographer, Thomas Medwin, who had also been with him at Sion House. Perhaps more important for his future was his interest in serious writers both practical and theoretical, Franklin, Pliny, Condorcet, who strengthened his native bent toward inquiry and were in part responsible for his early abandonment of religious orthodoxy.

Shelley left Eton, with somewhat unexplained abruptness, in the summer of 1809; he matriculated at University College, Oxford, 10 April 1810. From the amount he published in the latter year it would seem that he spent much of the interim in writing, and it is known that he had a love affair with a cousin, Harriet Grove. At Oxford he formed a friendship with the able, rather cynical Thomas Jefferson Hogg, and was encouraged in his wholesale recalcitrancy. The university was little hospitable to advanced ideas, and when Shelley sent to bishops and heads of colleges copies of his syllabus of arguments demonstrating «The Necessity of Atheism,» it was small wonder, though a great pity, that, on his failure to answer their questions, the authorities should have handed him a sentence of expulsion already signed and sealed. (25 March 1811.) Hogg protested and was also expelled.

The offending pamphlet was Shelley's sixth publication, and he still lacked several months of being twenty. In 1810 he had published — how is something of a mystery — 'Zastrozzi;'

Digitized by Google

Percy B Shelley

Digitized by Google

Digitized by Google

'Oriental Poetry. By Victor and Cazire' (written in conjunction with his sister Elizabeth, withdrawn on the ground that she had borrowed from "Monk" Lewis, long sought for in vain, but finally edited by Dr. Richard Garnett in 1898); 'Posthumous Fragments of Margaret Nicholson' (the mad woman who had tried to kill George III.); and 'Saint Irvyne; or, the Rosicrucian,' another Radcliffian romance It is needless to say that these productions are devoid of intrinsic merit. His fifth publication was 'A Political View of the Existing State of Things,' issued anonymously at Oxford for the benefit of Peter Finerty, a prisoner for libel. This has entirely disappeared.

Shelley left Oxford with mingled regret and indignation, and took lodgings in London. His affair with his cousin Harriet Grove had been broken off, and he was soon involved in the most unhappy entanglement of his much entangled life. Not being permitted to come home unless he would break with Hogg and refusing to do this, he found himself adrift in London, and fate brought him in contact with a friend of his sister Elizabeth's, Harriet Westbrook, the pretty daughter of a retired hotel-keeper. She was romantic and fancied herself persecuted by her family; Shelley was also romantic, and persecuted, and quixotic, and inflammable. When he went out of town in July 1811 she wrote him pitiful letters, which so worked upon his feelings that he returned to London, ran away with her, and married her at Edinburgh at the end of August. How far the girl's relatives connived at the capture of the baronet's son cannot be ascertained. Naturally the Shelleys were indignant, and cut off the madcap's allowance; but Mr. Westbrook allowed them £200 a year, and finally Shelley's father contributed the same amount.

It is unnecessary to detail their movements at this juncture save to say that they spent some months at Keswick near Southey and then, Shelley being inspired by the theories of William Godwin (q. v.), they went over to Ireland to attempt to redress the wrongs of the long-suffering people. They were accompanied by Harriet's sister, Eliza Westbrook, whose presence grew distasteful to Shelley, and they remained only about two months, since the Irish did not respond enthusiastically to Shelley's pamphlets. He was merely a visionary a little ahead of his times, for Catholic emancipation came peacefully not so many years after his death. When he returned to England, he excited the attention of the government by revolutionary writings, but he was not molested. Believing, however that an attempt had been made to assassinate him, he returned with his wife and sister-in-law to Ireland, and then he went with Harriet to London, where their first child was born (June 1813). About this time he printed privately his nebulous poem of free-thought 'Queen Mab,' accompanied by notes and a "vindication" of vegetarianism to which he had become a convert. Eight years later a pirated edition brought 'Queen Mab' into notoriety, much to its author's disgust. A dialogue pamphlet, 'A Refutation of Deism' (1814), followed, bringing his publications up to the number of fourteen. Meanwhile he and Harriet had become estranged, partly no doubt from natural incompatibility, partly from Shelley's instability, to use no stronger term. Critics and readers will probably never agree as to the exact distribution of responsibility between the unfortunate pair; but it seems manifest that admiration for Shelley's genius has unduly influenced many of his biographers in their treatment of the matter. He met Mary, the daughter of William and Mary Wollstonecraft Godwin, and, as before with Harriet, found an attractive girl pining for sympathy at a time when he himself stood in need of it. She was a much more congenial partner for him than the innkeeper's daughter, to whom he had just been remarried according to the rites of the Church of England, and, after Harriet made the mistake of leaving him and going with her child to her father's at Bath, he lost little time in persuading his new seventeen-year-old friend to elope with him.

They left England on 28 July 1814 taking with them Jane (Claire) Clairmont, a daughter of Godwin's second wife by a former marriage. They spent some time in Switzerland and then, after some financial difficulties, returned to England in September. Their experiences were later recounted by Mary Shelley in 'The History of a Six Weeks' Tour' (1817). Meanwhile Shelley had made Harriet the astounding proposition that she should live with him and Mary, and ... er his return to England he saw her and the son she had borne him during their separation. No reconciliation was effected, however, and Shelley naturally found himself cut off from all his former sources of income. The death of his grandfather early in 1815 induced his father to allow him £1,000 a year in order to guard against his encumbering the family estate. He settled £200 a year on Harriet, took a house near Windsor Forest, wrote 'Alastor' (1816, a poem still immature in thought, but indicating a great advance in his command of poetic technic), and studied the classics. In May 1816 he went again to Switzerland with Mary and Jane Clairmont, and there he came under Byron's (q. v.) sway, exerting in his turn a strong influence upon his new friend. The autumn found Shelley back in England established at Great Marlow. Here, in December 1816, he learned of Harriet's suicide in the Serpentine. The immediate causes of the act are obscure; but, whether or not the charges that have been made against Harriet's morals during the closing months of her life are fully or partially justified, it seems absurd to acquit Shelley of all responsibility for her tragic fate.

He was now free to marry Mary Godwin (30 Dec. 1816) but the law would not allow him to recover the control of his two children by Harriet. Shelley resented Lord Eldon's decision, with some justice so far as the management of their education was concerned; yet he had certainly so conducted himself as to make the Chancellor's decision seem equitable to most people at the time. Meanwhile a son, William, had been born to him and Mary, Leigh Hunt had become a friend, and Keats an acquaintance, and the elaborate narrative and allegorical poem 'Laon and Cythna' had been begun. Two political tracts were also published and, true to the humanitarian principles that always actuated his conduct, even when its effects were deleterious to others, Shelley ministered to the sick and needy around him. His charity seemed boundless, and during his visitations he con-

Digitized by Google

tracted a bad case of ophthalmia. His health had been otherwise poor and, as for many reasons England was not a congenial dwelling-place, he determined to go to Italy. He left England with his family, and by the end of March 1818 was at Turin. Two months previously Ollier had reissued under the title of 'The Revolt of Islam,' the long poem, which, on its first appearance, had been entitled 'Laon and Cythna.' The relationship between the hero and heroine had been too close to suit any save the most emancipated readers, and Shelley had reluctantly made a few alterations, in the interest not so much of conventionality as of the success of the poem as a plea for the cause of oppressed peoples. No changes could make so long and misty a performance popular; but lovers of poetry will always find 'The Revolt of Islam' incomparable for its glowing pictures and its exquisite melodies. Both in its merits and in its defects it reflects, as though it were a mirror, its author's unique, attractive, yet singularly incomplete and unbalanced genius.

The first months in Italy were spent at Lake Como, Milan, and the Baths of Lucca, and saw the completion of the romantic poem 'Rosalind and Helen' and the translation of Plato's 'Symposium.' Then Shelley with Jane Clairmont took a disagreeable journey to Venice to see Byron with regard to Miss Clairmont's illegitimate daughter Allegra. (See BYRON.) The poem 'Julian and Maddalo' commemorates some features of the visit. Byron loaned Shelley a villa at Este, and the latter at once sent for his family. A few weeks later Mary's second child, Clara, died at Venice. Returning to Este, Shelley began 'Prometheus Unbound' and, charmed by the scenery, wrote the first draft of his beautiful 'Lines Written Among the Euganean Hills.' The winter of 1818–19 was spent at Naples, which inspired, among other things, the 'Lines Written in Dejection,' and a magnificent ode to the beautiful and oppressed city. He also wrote to his friend Thomas Love Peacock letters justly famous for their powers of description and admirable prose style. The spring of 1819 found him settled in Rome hard at work upon what is often regarded as his greatest achievement, the aspiring but somewhat nebulous lyrical drama, 'Prometheus Unbound,' published in 1820. Immediately after this he wrote the much more realistic tragedy entitled 'The Cenci,' probably the least subjective of his works, which was composed and published at Leghorn in 1819. Shortly before he left Rome in the summer, his son William sickened and died. The well-nigh heart-broken parents retired to Leghorn and then to Florence, where another son, afterward Sir Percy Florence Shelley, was born. Here in October Shelley wrote that splendid poem, probably the most nobly imaginative of all his lyrics, the 'Ode to the West Wind,' as well as two of his less successful, posthumously published poems, the parody 'Peter Bell the Third' and 'The Masque of Anarchy,' inspired respectively by Wordsworth's famous poem and by the infamous Manchester Massacre.

The beginning of 1820 saw the wanderers established at Pisa, where Shelley's health began to improve. Several English friends, the Gisbornes and the Williams's, and later Lord Byron and the traveller, Trelawny, added to the attractions of the place and stimulated Shelley's genius, if not to the production of any elaborate poems of consequence save 'Adonais' and 'Hellas,' at least to the writing of some of his most beautiful lyrics and charming familiar pieces. Among the poems of 1820 were the 'Epistle to Maria Gisborne,' the fantastic 'Witch of Atlas,' the exquisite 'Sensitive Plant,' and those matchless lyrics of their kind, 'The Cloud' and the 'Ode to a Skylark.' The chief productions of 1821 were the Platonic 'Epipsychidion,' the final form of which was inspired by an idealistic passion Shelley conceived for Emilia Viviani, an Italian girl confined in a convent against her will, the delightful and eloquent 'Defence of Poetry' (in prose), the immortal elegy on Keats, 'Adonais' (Pisa 1821), and 'Hellas,' a lyrical drama reflecting the emotions kindled in its liberty-loving author by the Greek revolution. The last named piece, in some of its choruses at least, gives evidence of such maturing powers that, when we take into account the range of Shelley's interests, mental and emotional, we find it difficult to set limits to his possible achievements if he had been permitted to live and had developed as steadily and as rapidly as he did during the closing years of his short life. It is true that 'Epipsychidion,' despite its marvellous beauty of description and its intensity of spiritual passion, shows that Shelley's idealism was still capable of giving an unwholesome turn to his writings and, to put it mildly, a fatuous twist to his conduct. It is true also that the part Shelley took in luring Leigh Hunt to Italy to start 'The Liberal' (see HUNT, J. H. L., and BYRON) scarcely argues a great increase in worldly wisdom, though it speaks volumes for Shelley's generosity. But, when all deductions are made, the development and the promise of Shelley's 28th, 29th, and 30th years are scarcely less remarkable than the development and promise of Keats in the marvellous year of his great odes and 'Lamia.'

In 1822 Shelley began a drama on Charles I., but did his best work on translations from 'Faust' and Calderon's 'Mágico Prodigioso' and on the highly imaginative 'Triumph of Life,' unfortunately left incomplete. In April the Shelleys went with the Williamses to Lerici, and there the friends passed an ideal time until the arrival of the Hunts drew the kind-hearted Shelley early in July to Leghorn and Pisa to look after their comfort. On the eighth of July he began his return journey with Williams in the yacht "Ariel," which they owned jointly. Trelawny watched them sail away, saw a squall come up, and when it was over, could catch sight of them no more. His suspicions that all was not well were allayed for a time; but, as the days passed, every one interested in the two voyagers lost hope. On 18 July Shelley's body — if the copies of Sophocles and Keats found in the pockets definitely marked it as his — was washed ashore near Via Reggio. It was first buried in the sand, then cremated — save the heart which would not burn — and the ashes were buried in the Protestant cemetery at Rome (7 Dec. 1822) under the pyramid of Caius Cestius and near the grave of Keats. There seems to be little reason to credit the notion that the yacht was designedly run down.

Digitized by Google

Shelley is said to have been tall and slender, very youthful in appearance, with a fair complexion and dark blue eyes full of artless wonder. Trelawny at first sight almost took him for a girl. His receptivity, gentleness, charity, and other exquisite traits suggest the woman as much as his appearance did; but his fiery hatred of oppression and shams, his calm defiance of public obloquy, his power to charm men of the world, forbid us to regard him as in any sense effeminate. In his writings no less than in his character and in his appearance this blending of essentially manly and essentially womanly characteristics is perceptible. His ideals were passive rather than active; his most indisputably successful poems are in theme and tone expressions of longing, weakness, pain, and sadness; his best descriptive passages are hazy; his verse is fluid and melodious rather than deeply harmonious. On the other hand, he has had the power to inspire strong souls with his ideals; more than any other of our poets he has caught the Greek secret of endowing with life mythical figures and conceptions; he was a scholar, a critic, a man of taste, and a prose-writer of no mean order; his genius was varied and copious beyond that of most of his contemporaries. With regard to his final rank in English literature no consensus of opinion seems attainable. While the public indifference that depressed him in his own day has long been overcome, he has never attained true popularity either at home or abroad, and his critics are only too likely to become his worshippers or else to display too openly a feeling of hostility toward his life and works. He is still too much the idol of advanced spirits and of people who are inclined to be a trifle exquisite in their literary tastes and somewhat supercilious with regard to the tastes of others. His position as a great poet is scarcely open to question, but his position as a genuine classic in the fullest sense of the term is surely doubtful so long as Matthew Arnold and other qualified critics dissent from the praise of his ideals, the defense of his conduct, and the enthusiasm for his elaborate poems such as 'Prometheus Unbound' to be encountered in extravagant measure in the books and essays of his admirers. Perhaps it is safe to conclude that, while his conduct must be censured in many particulars, his character must be pronounced singularly winning and lovable, and, that, while his elaborate poems, though wonderful, are not sustained works of art, his genius as a lyrical poet is in range and quality unique and extraordinarily high.

Bibliography.— Various volumes of Shelley's poems, imperfect and in some cases pirated, helped to spread his small reputation until 1839, when Mrs. Shelley published an edition of his works in four volumes. Many important poems and letters have since been published — e. g., in Richard Garnett's 'Relics of Shelley' (1862). The most complete edition of the works in verse and prose is that by H. B. Forman (8 vols., 1876–80). There are good editions of the poetry — in several volumes — by Forman (the new 'Aldine,' 1892), G. E. Woodberry, and others — also in one volume by Dowden ('Globe'), Woodberry (American 'Cambridge'), and T. Hutchinson ('Oxford,' 1904 — the latest and fullest). The prose works were edited by R. H. Shepherd in 1888 (2 vols.). The authoritative biography is that by Edward Dowden (2 vols., 1886) — too plainly the work of an advocate, as J. C. Jeaffreson's 'The Real Shelley' (2 vols., 1885) is the work of a prosecutor. Two good short biographies are those by J. A. Symonds ('English Men of Letters,' 1878) and William Sharp ('Great Writers,' 1887, with a bibliography). See also works by F. Rabbe, H. S. Salt, and others and, of course, the earlier lives by Medwin (1847) and Hogg (1858), Trelawny's 'Recollections of Shelley and Byron,' Leigh Hunt's 'Autobiography,' and other books by this devoted friend, etc. Of critical essays there is a large number and variety — see especially those by Matthew Arnold, Walter Bagehot, Dowden, Garnett, Leslie Stephen, and Woodberry. For bibliography consult Forman's 'Shelley Library.'

WILLIAM P. TRENT,
Professor of English Literature, Columbia University.

Shelter Island, N. Y., island and township, Suffolk county: situated at the eastern end of Long Island between Peconic and Gardiner's Bays; length eight miles; width four. It is connected with the mainland and the Long Island Railroad by ferry to Greenport. The island was originally owned by the Manhasset Indians; was acquired by Lord Sterling, and during colonial times belonged to the jurisdiction of Connecticut. The coast line is irregular and deeply indented with small bays and inlets, affording good harbors for yachts and small craft; there are excellent facilities for pleasure boating and fishing, and the island is a popular summer resort and a Methodist camp-meeting place. The New York Yacht Club has a station on the northern coast. Pop. (1890) 921; (1900) 1,066; (1910 est.) 1,200.

Shem, the eldest son of Noah; according to the Mosaic account, he is the father of all the nations that inhabited southwestern Asia (Gen. x. 21–31), a territory inclusive of Syria, Chaldæa, parts of Assyria, of Persia, and of the Arabian peninsula. Hence the inhabitants are called Semites, and their language and civilization styled Semitic. See SEMITIC LANGUAGES.

Shemakha, shĕ-mä-kä', Russia, in Transcaucasia, on the Zagolovai, about 63 miles northwest of Baku. It is situated in the midst of mountains, on verdant slopes and was once a commercial centre. It has, however, suffered from earthquakes, and one in 1902 almost destroyed it. Silk manufacture is the chief industry. Shemakha's history from 1712 was one of almost continuous warfare; it was captured and occupied in turn by various Persian, Turkish, and Russian commanders. Pop. 25,000.

Shen-si, shĕn-sē', China, a northern interior province, bounded on the north by the Great Wall, which divides it from Mongolia, on the east by Shan-si and Honan, on the southeast by Hu-peh, on the south by Sze-chuen, and on the west by Kan-su; area, 75,270 square miles. It is traversed by the Pehling range, separating the basins of the Hwang-ho and Yang-tse or Yellow and Great Rivers; is well watered, chiefly by the Wei-ho, Loh, and Wu-ting; produces good crops of wheat, millet, and

Digitized by Google

cotton; rears great numbers of horses, cattle, goats, and sheep; and has mines of iron, copper, lead, coal, and gold. These, with rhubarb, musk, and wax, are the chief exports. Pop. 8,450,200.

Shenandoah, shĕn-an-dō'a, Pa., borough in Schuylkill County; on the Pennsylvania, the Philadelphia & R., and the Lehigh Valley R.R.'s; about 100 miles northwest of Philadelphia and 12 miles north by east of Pottsville, the county-seat. The place was settled about 1850 by William Kelley, but was not laid out as a city until 1862; in 1866 it was incorporated as a borough. It is the commercial and industrial centre of a region rich in anthracite coal; six of the largest collieries in the country are within the limits of the borough, and a number of other large collieries are within a one-mile radius. The chief industries of the place are connected with the mining and shipping of coal; machine shops, mining-tool works, and foundries are among the manufactories. Other manufacturing establishments are hat and cap factories, brewery, and printing establishments. There are 20 churches, representing seven different denominations, seven public schools, five parish schools, and a public library. The two national banks have a combined capital of $200,000. There are also a savings bank and three building and loan associations. The government is administered by a chief burgess and a council of 15 members chosen at popular election. Pop. (1880) 10,147; (1890) 15,944; (1900) 20,321; (1910) 25,774.

Shenandoah, a river in Virginia which has its source in Augusta County, and flows northeast, on the west side of and nearly parallel to the Blue Ridge. It enters the Potomac at Harper's Ferry, W. Va. Its total length is about 170 miles. It flows rapidly over nearly all its course and furnishes extensive water-power which is used for manufacturing and has contributed greatly toward the industrial prosperity of the valley.

Shenandoah, The, a ship named after the Shenandoah River, Virginia, bought by the Confederate States during the American War of the Confederacy and in commission as a privateer during the last year of that war. The Shenandoah was built in Glasgow in 1863; she was intended for the far Eastern trade but was purchased by the Confederates in 1864 and in October of that year was commissioned as a privateer. The ship, named the Sea King, had sailed from London for Madeira, where she received her privateersman's crew, composed mostly of officers from the Sumter, the Alabama, then destroyed, and the Georgia, and common sailors, under the command of Captain James I. Waddell. The Shenandoah sailed from Madeira and circumnavigated the globe, via Melbourne, being the only Confederate vessel to do so. In the course of her career she captured or destroyed 39 of the enemy's vessels, valued in the aggregate at about $2,000,000. Her last action, the last hostility of the war, was on 28 June 1865, about three months after the war had ended, when the Shenandoah appeared among the American whalers near the Bering Straits and captured ten vessels before nightfall. On 2 August Captain Waddell learned from an English bark of Lee's surrender, five months before. He sailed at once to Liverpool and delivered his ship to the British man-of-war Donegal, never having been captured nor defeated in his entire career. The British government released all of the crew not British-born and turned the vessel over to the American consul.

Shenandoah Mountains, a range in Virginia, belonging to the Alleghanies, extending northeast and southwest, and forming the western boundary of the Shenandoah Valley.

Shenandoah Valley, Va., between the Shenandoah Mountains on the west and the Blue Ridge Mountains on the east. It is noted for its beautiful scenery, and the variety and beauty of its vegetation. The large forests found here contain chestnut, hickory, oak, and other hardwood trees. The valley acquired a world-wide fame during the Civil War, when it was the scene of many encounters. In 1862 took place here the campaign of "Stonewall" Jackson (q.v.), and in 1864 it was the scene of the campaigning of Philip Henry Sheridan (q.v.).

Shenandoah Valley, Military Operations in. At the beginning of the Civil War the Shenandoah Valley was the garden spot of Virginia, full of grain and hay, and teeming with live stock and other supplies essential to the Confederates. It became the beaten track and alternately the camping-ground of both armies, witnessed much brilliant strategy and many hard-fought battles, and at the close of the war was a scene of desolation. Its topography favored the Confederates, since, as covered on the east by the Blue Ridge, it was the easiest route for threatening Washington, and the most direct route for their armies to move into Maryland and Pennsylvania.

1861.— Virginia passed an ordinance of secession on 17 April, and the next night State troops moving, without authority of the governor, from Staunton and other points in the valley, seized Harper's Ferry, with its arsenal, armory, and munitions of war, the small United States guard abandoning the place and retreating to Carlisle, Pa. The town was speedily occupied by several Virginia regiments, and Col. T. J. Jackson put in command. Jackson was relieved by Gen. J. E. Johnston 23 May. Upon the dash of Col. Lew Wallace on Romney (q.v.), 13 June, and the approach of Gen. R. Patterson from Chambersburg to Williamsport, threatening his position, Johnston, 15 June, burned all the bridges of the Potomac from Harper's Ferry northward to Williamsport, abandoned Harper's Ferry and fell back to Winchester. On 2 July Patterson crossed the Potomac at Williamsport, occupied Martinsburg and, under Gen. Scott's order, threatened Johnston at Winchester, to hold him there, while Gen. McDowell advanced on Gen. Beauregard at Bull Run; but, 18 July, Johnston eluded Patterson, and with 9,000 men marched through Ashby's Gap to Piedmont and took cars for Manassas. The Union occupation of the lower valley was brief; Patterson, after Johnston had left his front, falling back to Harper's Ferry, where 25 July he was relieved by Gen. Banks, and the Union troops, save a small guard at Harper's Ferry, were withdrawn to the Maryland side of the Potomac. Late in October "Stonewall" Jackson was assigned to the command of the Confederate forces in the lower valley, with headquarters at Winchester, and was reinforced by

Digitized by Google

Loring's division from West Virginia. Jackson swept the few Union outposts from the fringes of the valley, broke the Baltimore and Ohio Railroad and Chesapeake and Ohio Canal in several places, as far westward as Hancock, and 10 Jan. 1862 drove the Union forces from Romney and occupied it with Loring's division. By orders of the Confederate secretary of war, 31 January, Loring was withdrawn from Romney to Winchester, where Jackson remained during the rest of the winter, the Union forces again occupying Romney on 7 February, demonstrating on Winchester, and sending expeditions southward to bring in cattle.

1862.— Active operations began in the valley late in February by the movement of two Union divisions across the Potomac at Harper's Ferry and an advance on Winchester, near which Lander's division from Romney and the south branch of the Potomac joined the column. Manassas and Centreville were evacuated by Gen. Johnston on 8 and 9 March, and Jackson, with his 5,000 men, under Johnston's order, abandoned Winchester on the night of the 11th, as he was on the eve of giving battle to Gen. Banks, and fell back up the valley 42 miles to Mount Jackson, followed by Shields' (formerly Lander's) division of Banks' corps. On the 20th Shields moved back to Winchester, followed by Jackson. Informed on the march that part of Banks' corps was being sent from the valley to reinforce McClellan east of the Blue Ridge, Jackson, in order to detain it in the valley, pressed Shields closely, skirmished with him on the evening of the 22d, and next day brought him to battle at Kernstown (q.v.), less than four miles south of Winchester, and being defeated, again retreated up the valley. His action had the desired effect; Williams' division, that was on the march through Snicker's Gap of the Blue Ridge, was recalled, and Banks again pursued Jackson up the valley as far as Harrisonburg, 66 miles from Winchester, Jackson falling back to Swift Run Gap, in the Blue Ridge, on the road from Harrisonburg to Gordonsville, where he watched an opportunity to strike Banks in flank and rear should he advance from Harrisonburg to Staunton. Under President Lincoln's order Banks fell back to Strasburg, and Gen. Frémont, commanding a corps, was ordered to move from Franklin and Monterey to co-operate with Banks in an advance on Staunton. Jackson, informed of Frémont's advance, made a rapid movement from Swift Run Gap to Staunton and, pushing through that place on 5 May, engaged Frémont's advance, under Gens. Schenck and Milroy, on the 8th, and in a hard-fought battle checked it, Schenck falling back to Franklin. (See McDowell, Battle of.) Jackson followed to Franklin, found Schenck too strongly posted to attack and on the 12th began his return march to the valley to attack Banks. On the 19th he started from Mount Solon, near Harrisonburg, on the 21st crossed the Massanutton Mountains from New Market to Luray, and, joined by Ewell's division, swept down the Luray Valley, with over 16,000 men and 48 guns, defeated Col. Kenly's command of 900 men at Front Royal (q.v.), 23 May and pursuing, captured the most of it. This movement turned Banks' fortified position at Strasburg, and on the morning of the 24th Banks retreated northward on the valley pike, was struck in flank by Jackson at Middletown and Newtown, but foiled his efforts to intercept him, and after a running fight from Middletown to Winchester, halted on the night of the 24th at Winchester to give battle. On the morning of the 25th Jackson attacked Banks, who had about 7,000 men, defeated him and drove him across the Potomac at Williamsport. (See Winchester, Battle of.) Jackson halted his main body a few miles beyond Winchester, but the cavalry followed Banks to the river. On the 28th Jackson sent part of his force toward Harper's Ferry, which made a demonstration, as though intending to force the position and cross into Maryland. Meanwhile Frémont and McDowell, moving respectively from Franklin on the west and Fredericksburg on the east, were converging on Strasburg, in Jackson's rear, to cut him off, upon which he abandoned his demonstration on Harper's Ferry and, starting from Winchester early in the morning of the 31st, by a rapid march slipped through the net prepared for him and arrived at Strasburg 1 June, Frémont's skirmishers being within a mile of the road over which he passed. Next day Frémont gave a stern chase on the valley pike, and Shields' division, now of McDowell's corps, marching by Luray Valley, endeavored to reach Jackson's rear or strike him in flank. Frémont pressed his rear closely in many sharp encounters, driving him steadily through Woodstock, Edenburg, and Mount Jackson; but Jackson, avoiding a general engagement, when arriving at Harrisonburg, sent his sick and wounded to Staunton, and 6 June, turning to the left, marched toward Port Republic. Later in the day his rear-guard had an encounter with Frémont's advance near Harrisonburg (q.v.), in which Gen. Turner Ashby, a gallant Confederate cavalry commander, was killed, and the result of which was that Frémont's advance was repulsed. Frémont advanced in force from Harrisonburg on the morning of the 8th, and at Cross Keys (q.v.) was met by Jackson, who, after a severe fight, repulsed him. Leaving Ewell's division to resist Frémont, should he renew the fight next morning, Jackson marched the rest of his army to Port Republic to meet Shields, who was moving up Luray Valley, and whose advance, under Col. Carroll, had dashed into Port Republic on the morning of the 8th, was driven out and joined later in the day by a brigade under Col. E. B. Tyler. Jackson attacked the two brigades of Tyler on the morning of the 9th, and at first was repulsed, but finally, on being reinforced, after a hard fight, drove Tyler from the field and back to Conrad's Store, on the other two brigades of Shields' division. (See Port Republic, Battle of.) Ewell had been recalled from Frémont's front, the bridge over the South Branch destroyed, thus checking Frémont's pursuit, and that night Jackson marched to Brown's Gap in the Blue Ridge. Frémont and Shields were ordered to cease pursuit and fall back, the former to Middletown to join Sigel and Banks, who had advanced from Harper's Ferry and Williamsport, the latter to join his corps at Fredericksburg. The Valley campaign of 1862 established Jackson's fame as a soldier. From the date of his arrival at Staun-

Digitized by Google

ton, 5 May, to the battle of Port Republic was 35 days, during which he had marched about 300 miles, fighting four battles and engaging in many other encounters, and with 16,000 men had kept 60,000 Union troops employed, and paralyzed McClellan's campaign against Richmond. On 17 June Jackson stole quietly away from Brown's Gap to join Lee on the Chickahominy. Munford's cavalry brigade and a few infantry were left in the valley to demonstrate in the direction of Strasburg, and Munford was soon relieved by Robertson's brigade, which took post at Harrisonburg and New Market. When Gen. Pope, 27 June, took command of the Army of Virginia, formed by the corps of Frémont, Banks, and McDowell, he withdrew Frémont and Banks from the valley to the east of the Blue Ridge, leaving garrisons of a small brigade each at Winchester, Martinsburg, and Harper's Ferry to cover the Baltimore and Ohio Railroad. Throughout July and August 1862 the valley enjoyed comparative quiet. In August Gen. Lee advanced upon Pope and drove him back to the defenses of Washington, then crossed the Potomac into Maryland by a route east of the Blue Ridge. Upon arriving at Frederick and finding, contrary to his expectations, that Martinsburg, Winchester, and Harper's Ferry were still held by Union troops, interposing on his proposed line of supply through the Shenandoah Valley and interfering with his intended movement into Pennsylvania, on 10 September he sent "Stonewall" Jackson across the Potomac at Williamsport to clear the valley of Union troops and capture those at Harper's Ferry. Winchester had already been abandoned; Gen. White was driven from Martinsburg to Harper's Ferry on the 11th, and on the morning of the 15th Harper's Ferry surrendered and the entire valley was once more in Confederate possession. When Lee withdrew across the Potomac, after the battle of Antietam, he halted a month on the Opequon and near Winchester; but when McClellan began crossing the Potomac at Berlin, on 25 October, and moved along the east foot of the Blue Ridge, Lee set his troops in motion up the valley, contesting with McClellan possession of the passes leading into the valley, and marching Longstreet's corps through Chester Gap to Culpeper Court House, leaving Jackson's corps in the valley, near Winchester, with one division at Chester Gap. McClellan was relieved from command of the Army of the Potomac 7 November, and Burnside, who succeeded him, marched for Fredericksburg, and when his advance appeared before that place on the 17th, Jackson withdrew from the valley by way of Swift Run Gap, and joined Lee at Fredericksburg, leaving in the valley a strong brigade of cavalry, supported by a small force of infantry. Union forces now crossed the Potomac and the Confederates were pushed up the valley to New Market, and again the Union troops occupied the lower valley, holding Winchester, Martinsburg, and Romney, with outposts at Strasburg, and scouting up the valley of the South Branch as far as Monterey. Under cover of this occupation the Baltimore and Ohio Railroad was repaired.

1863.— Active operations in the valley began this year by a Confederate raid from near Staunton to destroy the Baltimore and Ohio Railroad west of New Creek, which resulted in several encounters, and was partially successful, many bridges being burned and the road broken in places as far westward as Clarksburg, W. Va. While these movements were in progress Gen. Lee defeated Hooker at Chancellorsville, after which he immediately began preparations for his second invasion of Maryland which culminated in the battle of Gettysburg, and chose the route through the Shenandoah Valley, which offered a safe line of operations, and was held by Union troops not sufficient in numbers to present a serious obstacle. Gen. Milroy, with about 9,000 men, occupied Winchester, with a brigade in observation at Berryville; Gen. Kelley, with 10,000 men, was at Harper's Ferry; and a detachment of 1,200 men and a battery, under Col. B. F. Smith, at Martinsburg. There were outposts at Romney, and also toward Strasburg and Front Royal, watching the Confederate cavalry and infantry under Gen. Jenkins in the upper valley. Lee began his movement 7 June by ordering Gen. Imboden, then near Monterey, to move on Romney, by way of the South Branch of the Potomac, and directing Jenkins, with his brigade of cavalry, to march down the valley and concentrate at Strasburg or Front Royal, to co-operate with the advance of the army. Ewell's corps, leaving Brandy Station on 10 June, passed through Chester Gap and, marching by way of Front Royal arrived at Cedarville on the evening of the 12th, where Ewell detached Jenkins' cavalry brigade and Rodes' division of infantry to capture MacReynolds' brigade at Berryville; but MacReynolds, discovering their approach, withdrew to Winchester, which he reached by a roundabout way, on the 13th. Rodes and Jenkins, avoiding Winchester, then pushed on to Martinsburg and, on the 14th, drove Smith and his battery from the place, capturing five guns of the battery that were retiring on the Williamsport road, Smith and his infantry escaping by crossing the Potomac at Shepherdstown Ford and moving to Maryland Heights. Meanwhile Ewell, with the two divisions of Early and Edward Johnson, marched direct on Winchester, surrounding and capturing most of Milroy's command, on the 15th, after a hard fight, part of those who escaped, reaching Harper's Ferry, and part crossing the Potomac at Hancock. (See WINCHESTER, SECOND BATTLE OF.) On the 15th Early crossed the Potomac at Williamsport and Shepherdstown Ford, and occupied Hagerstown and Sharpsburg. On the 17th the garrison at Harper's Ferry was withdrawn to Maryland Heights. Imboden had driven the Union troops from Romney, and collected a large herd of cattle, and once more the valley of the Shenandoah was cleared of Union troops. Gen. Lee reports that as the result of these operations Ewell captured 4,000 prisoners, with their arms, 28 guns, 11 colors, 300 loaded wagons, with their teams, and a considerable quantity of stores of all descriptions. After Gettysburg Lee recrossed the Potomac at Williamsport on the night of 13 July and marched to Winchester and Bunker Hill. When Meade crossed the Potomac south of Harper's Ferry, Longstreet's corps moved up the valley, crossed the Blue Ridge at Chester Gap, and marched to Cul-

Digitized by Google

peper Court House, where it arrived on the 24th. A. P. Hill's corps followed by the same route, and Ewell's, after pursuing Kelley's Union troops west of Martinsburg, found Chester Gap and Manassas Gap held by Meade, who was marching along the east side of the Blue Ridge, and crossing higher up, at Thornton's Gap, joined the army at Culpeper. (See MANASSAS GAP, ENGAGEMENT AT.) Again the lower valley was reoccupied by Union troops, and remained in their possession at the opening of the campaign of 1864. Late in the year Gen. Early was put in command of two infantry brigades and some cavalry to hold the upper valley, annoy the Union forces at Winchester, and collect and bring away everything useful to the Union troops or his own, and especially to buy or seize cattle, horses, sheep, and hogs, in which the lower valley and that of the South Branch abounded. His instructions to do this were carried out to the letter, and the winter of 1863-4 witnessed one of the most remarkable foraging campaigns known, in which the lower valley and that of the South Branch were stripped of thousands of animals. These foraging parties brought on many collisions between the opposing troops.

1864.—In the general movement planned by Gen. Grant for the armies under his command in May 1864, Gen. Sigel, who had command in the Shenandoah Valley, was to advance from Harper's Ferry and Winchester up the valley, seize the rich stores of grain, and form a junction with Gen. Crook, who, with cavalry, infantry, and artillery, was to march from the mouth of Gauley River, W. Va., to destroy the Virginia and Tennessee Railroad and reinforce Sigel at Staunton, for a movement on Lynchburg. Sigel had about 24,000 men in his department, most of them guarding the railroad from the Monocacy and Harper's Ferry to Parkersburg and Wheeling. He concentrated part of his command at Winchester, ordered his cavalry to Cedar Creek and Strasburg and, starting from Winchester 9 May, with 5,500 infantry and artillery, 1,000 cavalry, and 28 guns, moved up the valley. His cavalry had several mishaps and was badly punished and, after a severe defeat of his command by Gen. Breckinridge at New Market, 15 May, he retreated to Cedar Creek. Gen. Hunter relieved him on the 21st and, being reinforced to 8,500 men, advanced upon Gen. W. E. Jones at Piedmont, defeated him there 5 June, and next day occupied Staunton. (See PIEDMONT, BATTLE OF.) At Staunton Hunter was joined by Gens. Crook and Averell, and began the work of destruction, thoroughly and quickly completed it, and on the 7th marched on Lynchburg, which he failed to take, and was driven westward by Gen. Early, who, with his corps of 8,000 men, had been sent by Gen. Lee, 12 June, from Gaines' Mill to expel Hunter from the valley and, if possible, destroy him, and then threaten Washington. It may here be stated that Hunter, Crook, and Averell marched to the Kanawha, and thus left the valley open to Early. On 23 June Early began his return march from the pursuit of Hunter, and reached Staunton on the 27th. He had been joined by Gen. Breckinridge's division of infantry, and McCausland's brigade of cavalry. On the 29th he sent the greater part of his cavalry to destroy the bridges of the Baltimore and Ohio Railroad, and with his main body pushed down the valley turnpike, reaching Winchester 2 July. After driving all the Union troops from the lower valley, and destroying as much as possible of the railroad and canal, he crossed the Potomac at Shepherdstown, demonstrated on Maryland Heights (q.v.), and marching through Frederick, defeated Gen. Lew Wallace at Monocacy (q.v.), 9 July, and then marched on Washington (q.v.). Failing to take Washington by surprise, as he had hoped to do, he retraced his steps, recrossed the Potomac at White's Ford on the 14th, and resting two days near Leesburg, moved on the morning of the 16th for the Shenandoah Valley by way of Snicker's Gap in the Blue Ridge; crossed the Shenandoah River at Snicker's Ferry, and on the 17th took position near Berryville. Meanwhile Hunter and Crook, who had retreated from Lynchburg to the Kanawha, had come by steamboat and railroad and joined the forces at Harper's Ferry, and on the 18th and 19th engaged Early at Snicker's Ferry and Berry's Ferry (q.v.) without success. During the 19th Early heard that Averell's division of cavalry, which also had come from the west, was marching from Martinsburg toward Winchester, threatening his rear, whereupon, during the night, he began a retreat to Strasburg. Averell defeated Ramseur's division at Stephenson's Depot on the 20th, which caused Early to move back with one division from Newtown to Winchester; but being threatened by the Union advance from Berryville, he again fell back to Newtown, and on the 21st concentrated his infantry near Middletown. Next day he fell back beyond Cedar Creek and covered all the roads from Winchester. Crook and Averell united their forces at Kernstown, and on the morning of the 24th Early again moved on Winchester, attacked Crook, and drove him back, pursuing beyond Winchester. (See KERNSTOWN, SECOND BATTLE OF.) Early continued the pursuit next day to Bunker Hill, Crook and Averell recrossing the Potomac. On the 26th Early marched to Martinsburg (q.v.), and devoted the 27th and 28th to the destruction of the railroad; and on the 29th McCausland crossed the Potomac on his noted raid to Chambersburg, Pa. (q.v.). Early remained at Martinsburg and Bunker Hill until 3 August, sending expeditions into Maryland by Williamsport and Shepherdstown fords to Hagerstown and Sharpsburg, collecting horses, cattle, and other supplies, and, recrossing the Potomac on the 6th, concentrated at Bunker Hill on the 7th.

Gen. Grant had been annoyed and disturbed by these Confederate irruptions and operations in the valley, and had come to the decision that it should be made untenable for either army and had framed instructions for Gen. Hunter to drive the Confederates from it and make it a waste, where no army could live. Hunter yielded the command to Gen. Sheridan, who assumed command 7 August and proceeded to carry out Grant's instructions. On the morning of the 10th Sheridan marched his army, which had been moved to Halltown, near Harper's Ferry, toward Early's line of communication, upon which Early abandoned Winchester on the 11th and fell back to Cedar Creek, followed by

Digitized by Google

Sheridan next day. At Cedar Creek Early received reinforcements — a division of infantry, two brigades of cavalry, and a battalion of artillery from Lee's army, all under command of Gen. R. H. Anderson — and resumed the offensive so aggressively with his cavalry, bringing on several sharp encounters, that Sheridan withdrew his infantry on the night of the 16th, his cavalry following next day, driving all the live stock in that part of the valley before it, and burning the grain from Cedar Creek to Berryville, near which Sheridan had taken position. Early pursued Sheridan on the morning of the 17th, struck and routed part of his command near Winchester, driving it through the town, and on the 21st moved with his whole army to attack Sheridan at Berryville. That night Sheridan, after some sharp encounters with Early's advance, fell back to Hall Town. For three days Early demonstrated on Sheridan's position, then, leaving one division in front of Sheridan, marched on the 25th, with four divisions and his cavalry, to Lee Town and toward Shepherdstown, his cavalry pushing on to Williamsport. Beyond Lee Town Early met and engaged Torbert's cavalry, driving it back to Shepherdstown. (See SHEPHERDSTOWN, ENGAGEMENTS AT.) Early remained that night at Shepherdstown, where he was joined next day by his cavalry, which had demonstrated on Williamsport, and the command returned to Winchester. On 28 August Sheridan advanced his infantry to Charlestown. Merritt's cavalry division, going by way of Lee Town, drove the Confederate cavalry from that place to Smithfield and across the Opequon. Next day Early drove Merritt back through Smithfield, but was checked and driven back across the Opequon by a division of Sheridan's infantry. (See SMITHFIELD, ENGAGEMENT AT.) There were now several minor encounters and counter demonstrations, and on the morning of 19 September Sheridan crossed the Opequon and in a hard-fought battle defeated Early, who retreated to Newtown and Fisher's Hill, near Strasburg. (See OPEQUON, BATTLE OF THE.) Sheridan followed on the 20th, and on the 21st again defeated Early at Fisher's Hill (q.v.), and pursued his retreating troops during the night and next day to Mount Jackson. Beyond New Market Early abandoned the valley pike and took a road leading to Port Republic. Sheridan, not having his cavalry with him, halted until it came up on the 25th, when it advanced to Staunton and Waynesborough, destroying the railroad between the two places, but, being threatened in flank and rear by Early, fell back, burning mills, store-houses, barns, grain, and forage, driving before them all live stock and devastating the whole width of the valley from Staunton northward. On the return march Sheridan's cavalry was harassed by that of the Confederates, who were turned upon and routed at Tom's Brook, 9 October, when Sheridan resumed his march down the valley, halting on the 10th on the north side of Cedar Creek. Early had followed, and on the morning of 19 October fell upon Sheridan's army and drove it back in some disorder, but it was rallied near Middletown and, resuming the offensive, defeated Early, who retreated to New Market. (See CEDAR CREEK, BATTLE OF.) This practically ended the Valley campaign of 1864. There were numerous raids and cavalry encounters, but no general movements or heavy engagements. Early remained in the vicinity of New Market until 16 December, when he fell back to near Staunton, and Sheridan went into winter quarters at Kernstown. Between the two there was no subsistence for man or beast; the valley had been desolated. One of Early's staff records in his diary that from the time of Early's appearance in the valley late in June till the middle of November he had marched 1,670 miles and had 75 battles and skirmishes.

1865.— During the winter the greater part of Early's command was sent to Gen. Lee at Petersburg, leaving Early a very small force of infantry and cavalry. On 27 February, Gen. Sheridan, with two well-equipped divisions of cavalry of 5,000 men each, started from Winchester on the last campaign up the Shenandoah Valley, and with but little opposition reached Staunton, Early falling back to Waynesborough. The work of destruction at Staunton was completed, and Early was followed to Waynesborough, where 2 March his command of 1,800 men was defeated and dispersed, most of them being captured, with all their colors, 11 guns, and train. (See WAYNESBOROUGH, BATTLE OF.) Sheridan then moved unmolested to the Virginia Central Railroad, which he destroyed for miles, and marched to White House, on the Pamunkey River, where he arrived 19 March, and then moved to join Grant's army before Petersburg.

There is no area upon which the armies contended that witnessed more brilliant strategy, fertility of resource, more rapid and exhausting marches, and more gallant fighting than that enclosed by the Alleghany Mountains and the Blue Ridge; there was no other section of the country whose inhabitants suffered more than did those of the Shenandoah Valley. Consult: 'Official Records,' Vols. II., V., XI., XII., XIX., XXI., XXV., XXVII., XXIX., XXXVII., XLII., XLIII., XLVI., LI.; Allan, 'Jackson's Valley Campaign'; Pond, 'The Shenandoah Valley in 1864'; Early, 'The Last Year of the War for Independence'; Kellogg, 'The Shenandoah Valley and Virginia, 1861 to 1865'; Sheridan, 'Personal Memoirs,' Vol. II.; The Century Company's 'Battles and Leaders of the Civil War,' Vols. I., II., III., IV.

E. A. CARMAN.

Sheng-king, shĕn-king', or **Liao Tung,** lyō-toong', Manchuria, the southernmost province, stretching into the Yellow Sea between the gulf of Liao Tung and Korea Bay, has an area of 37,000 square miles, a pleasant climate, and is generally fertile. Pop. 6,000,000. The southern portion of the province is known as the Liao Tung Peninsula; at the extremity is Port Arthur (q.v.), taken by Japan in the war of 1894–5, but retroceded to China on the payment of 30,000,000 taels ($21,300,000). In 1898, however, the Chinese leased it and adjacent territory including Talienwan or Dalny, to Russia. Consequent on the Boxer troubles of 1901 Russia occupied the whole of Manchuria, and rapidly proceeded to colonize it. This procedure was interrupted by the Russo-Japanese war of 1904. See MANCHURIA.

Shen'stone, William, English poet and landscape-gardener: b. Hales Owens, Worcester-

Digitized by Google

shire, November 1714; d. there 11 Feb. 1763. He was educated at Oxford, and intended entering a profession, but after inheriting his father's estate, Leasowes, lived in retirement upon it, devoting his life to its embellishment and to writing poetry, much of which was very popular, though little of it is now remembered. Among his poems are 'The Schoolmistress' (1742); 'Pastoral Ballad' (1743); and the stanzas 'Written in an Inn.' His complete works were published in three volumes (1764–9), and an edition of his poems with a memoir by Gilfillan appeared in 1854.

Sheol, shē'ōl, a Hebrew word signifying the place of the dead. Wherever it occurs in the Hebrew text it is rendered in the authorized English version by "grave" or by "hell," or by "pit." In the revised version "Sheol" is generally left untranslated in the text, while "grave" is put in the margin. See HADES: HELL.

Shep'ard, Charles Upham, American mineralogist: b. Little Compton, R. I., 29 June 1804; d. Charleston, S. C., 1 May 1886. He was graduated from Amherst in 1824 and made a special study of botany and mineralogy in the following year. He was lecturer on natural history at Yale in 1830–47, occupied the chair of chemistry at the Medical College of South Carolina in 1854–61 and resumed it for a few years after the Civil War. He was professor of chemistry and natural history at Amherst in 1845–52, and from 1852–77 was lecturer on natural history, after which he was made professor emeritus. His investigations resulted in the discovery of a new species of microlite in 1835, of warwickite in 1838, and of danburite in 1839, and he was also the discoverer of valuable deposits of phosphate of lime near Charleston which have proved of great value to agriculture, and their use in the manufacture of superphosphate fertilizers has made an important addition to the chemical industries of South Carolina. His collection of minerals was at one time the best in the country, but was unfortunately partially destroyed by fire three years after its purchase by Amherst in 1877. In addition to his numerous scientific papers his publications include: 'Report on the Geological Survey of Connecticut' (1837); 'Treatise on Mineralogy' (1855); etc.

Shepard, Edward Morse, American lawyer b. New York 1850; d. 28 July 1911. He was graduated from the College of the City of New York in 1869, studied law and was admitted to the bar. He established a practice in Brooklyn, and was an active member of the Democratic party there, being one of the organizers of the Young Men's Democratic Club of Brooklyn. He held no public office except as member of the civil service commission of the city in 1883–5, and chairman of that commission in 1888–90. In 1884–5 he was a State forestry commissioner, and was the author of the Commission's report for that year. In 1901 he was the regular Democratic nominee for mayor of Greater New York, but was defeated. For several years he was counsel for the New York Rapid Transit Commission, and resigned that position in March 1904 to become general counsel for the Pennsylvania Railroad.

Shepard, William, American soldier: b. Boston, Mass., 1 Dec. 1737; d. Westfield, Mass., 11 Nov. 1817. He enlisted in the provincial army at the outbreak of the French and Indian war and served until 1763, participating in the battles of Fort William Henry and Crown Point, and attaining rank as captain. He entered the Continental service at the beginning of the American Revolution, became colonel in 1777 and served until the close of the war. He was engaged in 22 battles, and won a high reputation for his courage and ability. In 1788–90 he was a member of the executive council and as brigadier-general in command of the militia he defended the arsenal in Springfield at the time of Shays' Rebellion in 1786. He was afterward promoted major-general of militia and in 1797–1803 served as member of Congress.

Shepherd Kings. See HYKSOS.

Shepherd's Purse, a small cruciferous weed (*Bursa bursa-pastoris*). It has rosettes of lobed or pinnatifid leaves, a short stem, branching into spreading pedicels carrying racemes of small white flowers, rapidly succeeded by triangularly heart-shaped capsules, which have suggested this name, and also those of mother's heart, case-weed, shepherd's bag, etc., by their resemblance to ancient wallets. Originally European, this plant has been naturalized throughout the temperate regions, blooming during the entire year, and was formerly used as an anti-scorbutic and in hæmatura.

Shep'herdstown, W. Va., town in Jefferson County; on the Potomac River, and on the Norfolk & Western railroad; about 65 miles west of Washington, D. C., and 10 miles above Harper's Ferry. It was settled in 1732; but there is good reason to believe a settlement was made as early as 1718, by German colonists from Pennsylvania. In 1762 it was incorporated as a town; first called Mecklenburg and afterward changed to Shepherdstown. It is in an agricultural region. The chief manufactory is a knitting factory. Other industrial establishments are a flour mill, machine shop, and cement-works. There are nine churches, two of which are for the colored. The educational institutions are Shepherd College, State Normal School, and graded public schools. The bank has a capital of $25,000. The government is vested in a mayor, recorder, and a council of five members, elected annually. Pop. (1900) 1,184; (1910) 1,276.

H. L. SNYDER,
Editor 'The Register.'

Shepherdstown, Engagements at and near. Situated in a great bend of the Potomac, nine miles east of Martinsburg, and on one of the principal routes from the Shenandoah Valley to Maryland, Shepherdstown, W. Va., was the scene of much activity during the Civil War. Both armies, at various times, crossed the Potomac at a ford about one mile below the town, which was used by the Confederates when they withdrew from the Antietam battlefield, 18–19 Sept. 1862, and by a great part of Lee's infantry when they marched to Gettysburg in June 1863. On 25 Sept. 1862 Gen. Pleasonton's cavalry division crossed the ford on a reconnoissance toward Martinsburg, and a few miles beyond Shepherdstown encountered the Confederates in some force, and was checked after capturing

Digitized by Google

a few men. Again (1 Oct. 1862) Pleasonton crossed the river, with 500 cavalry and a battery of six guns, drove the 9th Virginia cavalry from Shepherdstown, and pursued it across the Opequon and into Martinsburg, where he encountered the rest of Col. W. H. F. Lee's brigade and a battery which were driven from the place. Pleasonton remained in the town until 5 P.M., when he started on his return march, followed by Confederate cavalry and two guns, with whom about dark he had an encounter when within a mile of Shepherdstown, after which he recrossed the Potomac. The loss was slight on both sides. On 16 Oct. 1862 in co-operation with Gen. Hancock's division, which advanced from Harper's Ferry toward Charlestown and Winchester, Gen. Humphreys, with about 500 cavalry, 6,000 infantry, and six guns, marched from Sharpsburg, crossed Shepherdstown Ford at 4 A.M., and moved toward Smithfield on a reconnoissance. A mile out of Shepherdstown his advance was contested by Fitzhugh Lee's cavalry brigade and two guns. Lee was driven beyond Kearneysville, where he was reinforced by cavalry and a brigade of infantry, but was driven back, and Humphreys went into bivouac. Humphreys resumed his march on the morning of the 17th, and 1½ miles beyond Kearneysville came upon Lee in a strong position. Not desiring to bring on an engagement, and having his cavalry make a dash on Smithfield, which was found occupied by Confederate cavalry, Humphreys returned to Sharpsburg by the way he had gone out, followed by cavalry and artillery as far as Shepherdstown.

After his Gettysburg campaign Gen. Lee recrossed the Potomac at Williamsport 14 July 1863. On that day, to watch his movements, Gen. Gregg's cavalry division was sent across the Potomac at Harper's Ferry, and on the 15th marched to Shepherdstown, driving some cavalry from the town that evening and encamping near. On the 16th, about 1 P.M., Gregg's advance, near Kearneysville was attacked by Gen. Fitzhugh Lee, with his own and Chambliss' brigade, supported by Jenkins' brigade. Gregg was gradually driven back upon his guns, when he rallied his command, and the sharp engagement was continued, lasting until dark, both sides dismounted. This engagement was on the Boteler farm, about a mile from town. During the early morning Gregg fell back to Harper's Ferry, with a loss of 70 killed, wounded and missing as the result of his fight on the 16th. The Confederate loss was 106.

On 21 Aug. 1864 Gen. Sheridan fell back from the line of the Opequon to Hall Town, near Harper's Ferry, the cavalry, under Gen. Torbert, being moved to his right at and near Shepherdstown. Gen. Early demonstrated on the position at Hall Town for three days, and on the 25th with the four infantry divisions of Rodes, Ramseur, Gordon, and Wharton, with their artillery, moved northward toward Shepherdstown, his cavalry at the same time moving on Williamsport to keep up the impression of an invasion of Maryland and Pennsylvania. Between Lee Town, seven miles southwest of Shepherdstown, and Kearneysville Early came upon Merritt's and Wilson's cavalry divisions, under Torbert who had marched from Shepherdstown and Duffield's that morning on a reconnoissance to Lee Town. Torbert promptly attacked Wharton's division, Early's advance, driving it back in confusion nearly a mile. Early brought up the rest of his command, and after a short and sharp contest in which artillery was freely used, Torbert ordered his two divisions to fall back, Wilson's by the route it had come, Merritt's by the direct road to Shepherdstown. Merritt was followed so closely by Early that when near Shepherdstown and on the Charlestown road, Custer's brigade was ordered out to repel the advance, in which it succeeded, driving it back; but it was in turn struck in flank and rear by Gordon's division, which had marched across the country. Devin's brigade was sent to Custer's relief, and engaged Gordon. Custer was cut off and, after a sharp fight, made his escape by crossing the Shepherdstown Ford into Maryland. It was now dark; Merritt rejoined Wilson, and both joined Sheridan. The loss was considerable on both sides. Early encamped near Shepherdstown, and next day moved back across the Opequon, and on the 27th to Bunker Hill.

E. A. CARMAN.

Shepherdstown (Boteler's) **Ford, Engagement at.** Gen. Lee withdrew from the field of Antietam during the night of 18 Sept. 1862, and recrossed the Potomac into Virginia by the Shepherdstown or Boteler's Ford, 1 mile below Shepherdstown and about 2½ miles from Sharpsburg. Leaving some artillery and two small infantry brigades at the ford to hold McClellan in check, he marched his army for the Opequon. On the morning of the 19th Pleasonton's cavalry followed Lee to the Potomac, and in the evening detachments of the Fifth corps forded the river, drove away the Confederate infantry, and seized some of the artillery. To ascertain how far Lee had retreated, Gen. Porter was authorized by McClellan to send a reconnoissance beyond the Potomac on the morning of the 20th, and Porter ordered over the divisions of Gens. Morell and Sykes. Before daylight two regiments crossed with spare horses, secured three guns that had been taken the night before, and took them to the Maryland side. At 8 o'clock Sykes crossed the river with Lovell's brigade of regulars and pushed out a mile on the Charlestown road, when he discovered the Confederates in force, upon which Lovell fell back, skirmishing, to the heights near the river, and Warren's small brigade of two regiments formed on his left. The Confederates encountered were Gen. A. P. Hill's division of six brigades, supported by three brigades under Gen. Early, all sent back by Gen. Lee when he heard that the Union advance had crossed the river. Hill's skirmishers had slowly pressed back Lovell, and meanwhile Barnes' brigade of Morell's division had crossed the river, under orders to go on the road to Shepherdstown; but Sykes ordered it straight to the top of a high steep bluff on the river-bank to connect with Lovell's right. Before Barnes' brigade had all taken position Sykes came to the conclusion that he was too largely outnumbered to remain on that side of the river, and ordered the troops to recross, which was done by the left in good order, under cover of a heavy artillery-fire from the Union batteries on the Maryland side; but the withdrawal on the right was not accomplished without disaster. The 118th Pennsylvania or "Corn-Exchange" regiment, 737 officers and men, had ascended the high bluff, and was not fairly in position when it was at-

Digitized by Google

tacked by five brigades of A. P. Hill's division. It made a good fight, but was attacked on both flanks and in front, Col. Prevost was wounded, and it was driven in disorder over the precipitous rocky bluff, many being killed and wounded in falling to the roadway below. The men began to cross the river, and the Confederates, advancing to the bluff, fired upon them as they were struggling to regain the opposite shore. Some were killed in the water; some were drowned; others, who took refuge in old lime-kilns on the bank of the river, were killed or wounded by careless firing of the Union batteries; and some surrendered. In this disastrous affair the regiment lost 63 killed, 101 wounded, and 105 missing, or 269 out of a total brigade loss of 317. A. P. Hill's loss was 30 killed and 231 wounded. The Union loss on the 19th and 20th was 71 killed, 161 wounded, and 131 missing; the Confederate loss, 33 killed and 252 wounded. After the engagement of the 20th A. P. Hill and Early marched from the field and joined the main body of the army, which bivouacked that night on the Opequon near Martinsburg. Consult: 'Official Records,' Vol. XIX.; Smith, 'History of the 118th Pennsylvania Volunteers.'

E. A. CARMAN.

Shepley, shĕp'lĭ, **George Foster,** American soldier and jurist: b. Saco, Maine, 1 Jan. 1819; d. Portland, Maine, 20 July 1878. He was graduated from Dartmouth in 1837, from the Dana Law School at Cambridge in 1839, and admitted to the bar in 1840. He settled in Portland in 1844, where he established a large practice and in 1848–9 and in 1853–61 he was United States attorney for Maine. In 1861 he was commissioned colonel of volunteers in the Union army, participated in General Butler's expedition against New Orleans, commanded as acting brigadier-general at Ship Island, and after the capture of New Orleans was appointed military commandant, acting mayor, and was in charge of the defenses of the city until 1862 when he was appointed military governor of Louisiana and commissioned brigadier-general of volunteers. He commanded the military district of Virginia and North Carolina in 1864, was with the army of the James in 1864–5, and entered Richmond 3 April 1865. He was appointed military governor of the city and held the command until June when he resigned and resumed his law practice. From 1869 until his death he served as United States circuit judge of the first judicial court of Maine. His decisions appear in Holmes' 'Reports' (1877).

Sheppard, shĕp'ard, **Elizabeth Sara,** English novelist: b. Blackheath 1830; d. Brixton 13 March 1862. She wrote 'Charles Auchester,' a still popular musical fiction which introduces Mendelssohn as Seraphael (1853); 'Counterparts, or the Cross of Love' (1854); 'My First Season' (1855); 'The Double Coronet' (1856); 'Rumor,' in which Beethoven is a prominent personage (1858), and other works. She is said to have used at times the pseudonym "E. Berger."

Sheppard, John (Jack), English criminal: b. Stepney Dec. 1702; d. Tyburn 16 Nov. 1724. He was brought up in the workhouse of Bishopsgate, his father having died the year after his birth. He was apprenticed to a carpenter, but falling in with bad company deserted his master and took to a life of thieving. He was first brought up in court in 1723 as a runaway apprentice, but having secured his release, he thenceforth, as he confessed, fell to robbing almost every one that stood in his way. Having offended Jonathan Wild, a broker of stolen goods and informer against thieves, his capture was effected 23 July 1724. He was tried at the Old Bailey and condemned to death, but before his execution was effected he escaped from prison twice. He was hanged at Tyburn in the presence, it is said, of over 200,000 people. He was celebrated by all the journals and chapbooks, and even by the divines, who exhorted their flocks to emulate him in a spiritual sense. Plays have been constructed around his personality and Harrison Ainsworth made him the hero of his novel 'Jack Sheppard' (1839).

Sherbrooke, shĕr'brŭk, **SIR John Coape,** English soldier: b. England 1764; d. Calverton, Nottinghamshire, 14 Feb. 1830. He was commissioned ensign in the army in 1780, served in Nova Scotia in 1781–5, and in 1796–1800 was on duty in India. He was sent to Egypt to negotiate a treaty with the Boys in 1807, and in 1808 was in temporary command of all the troops in Sicily. He later served in Portugal, was second in command to Wellesley in the campaign of 1809, and was awarded a medal for gallant conduct at Talavera. In 1811 he became lieutenant-general and was appointed governor-general of Nova Scotia, and in 1816 he became captain-general and governor-in-chief of Canada. He resigned in 1818 in consequence of a paralytic stroke and lived the remainder of his life in retirement.

Sherbrooke, Robert Lowe, VISCOUNT. See LOWE, ROBERT.

Sherbrooke, Canada, city and county-seat of Sherbrooke County, Quebec; on the Canadian P., Grand T., Boston & M., and Quebec Central railways; 101 miles east of Montreal. The city is built on both sides of the Magog River at its junction with the Saint Francis, and both rivers are crossed by fine bridges and afford abundant water power for manufacturing. The most important industry is the manufacture of woolen cloth, one mill employing nearly 1,000 persons; other manufactures are paper, cotton goods, carpets, clothing, foundry products, machinery, axes, bobbins, electrical supplies, and cigars; and there are breweries, tanneries, and flour and lumber mills. Copper, asbestos, and chrome iron ore are mined in the vicinity. The local trade is important, and lumber, paper pulp, asbestos, copper, and lime are exported to the United States. It is the seat of a Roman Catholic bishop, and has fine county buildings, post-office building, several churches, an academy, good schools, banks, and daily, semi-weekly, and weekly newspapers. Pop. about 12,000.

Shere Ali Khan, shēr ä'lē khän, Ameer of Afghanistan: b. about 1825; d. Mezaricheff 21 Feb. 1879. He was the younger son by a favorite wife of Dost Mohammed Khan and was nominated successor to the throne to the exclusion of Mohammed Afzal Khan, the eldest son by another wife. Dost Mohammed died in 1863

Digitized by Google

and a fratricidal war ensued to determine the possession of the throne. In December 1863 Shere Ali secured the recognition of the British government to his succession, and in the contest that followed Mohammed Afzal was taken prisoner. The brother and son of the latter, who retained possession of Afghan-Turkestan, renewed the war and in a battle which took place in May 1866 the majority of Shere Ali's troops deserted to the enemy. For the next three years Shere Ali's fortunes ebbed and flowed and at times he seemed likely to lose his throne forever. In 1869, however, with the recognition of the English he was fully established on the throne of Kabul. In 1877 he became estranged from the British government, and refused to receive a British mission at Kabul. At the same time he made overtures to Russia, and received her mission, while relations between Russia and Great Britain were strained. The British mission being a second time repulsed, war was declared and the British invaded Afghanistan. Shere Ali fled at the proach of the British and determined upon making personal appeal at Saint Petersburg for an alliance against the English. The Russian government sent him messages declining to enter into any such alliance, but he persisted in his journey until he had crossed the Russian frontier, where he died suddenly.

Sher'idan, Philip Henry, American soldier: b. Albany, N. Y., 6 March 1831; d. Nonquitt, Mass., 5 Aug. 1888. He was graduated at the United States Military Academy in 1853, ranking 34th in a class of 52. He served in the 3d and 4th infantry regiments in the West until May 1861, when he was appointed captain in the 13th Infantry. In December 1861 he was made quartermaster and commissary of the Union army in southwestern Missouri. He was Halleck's quartermaster during the Corinth campaign in 1862. In May 1862 he was appointed colonel of the 2d Michigan cavalry and was made brigadier-general of volunteers in July. He served with distinction in the battles of Perryville and Stone River (qq.v.), and was made major-general of volunteers 31 Dec. 1862. In 1863 he distinguished himself in the bloody battle of Chickamauga (q.v.), and also bore an important part in the battle of Chattanooga (q.v.), where he attracted the attention of General Grant, who, when he assumed command in Virginia, had Sheridan transferred (April 1864) to the Army of the Potomac as commander of the cavalry corps. Sheridan was actively engaged in the battles of the Wilderness, Spottsylvania Court House, Cold Harbor (qq.v.), etc. From 9-25 May 1864 he raided the Confederate communications around Richmond, destroying ten miles of track on three important railroads, cutting the telegraph wires, capturing several trains, and causing much alarm in the Confederate capital. On 28 May he fought the battle of Hawes' Shop (q.v.) and 11 June that of Trevilian's Station. Nearly every day in May, June, and July Sheridan's cavalry was engaged with the Confederate troops or raiding their communications. On 7 Aug. 1864 he was placed in command of the Army of the Shenandoah with instructions to clear the Confederates out of the Valley. He defeated Early at Winchester (q.v.) 19 September, and at Fisher's Hill 22 September, and was rewarded by being made a brigadier-general in the regular army. After the battle of Fisher's Hill he laid waste the Shenandoah Valley. Practically everything destructible was destroyed, and the horses, cattle, and sheep were driven out. His object in devastating the country was to prevent future expeditions by the Confederates up the Valley by destroying the means of subsistence. The non-combatants were reduced to the verge of starvation, and Sheridan has been much censured for his course. On 19 Oct. 1864 his army was surprised and routed in the battle of Cedar Creek (q.v.) by Early, who neglected to pursue. Sheridan, who was 20 miles away when the battle began, made his famous ride, rallied his demoralized troops, returned, and decisively defeated the army of Early. On 8 Nov. 1864 Sheridan was made major-general in the regular army. From 27 Feb. to 24 March 1865 he made a raid from Winchester to Petersburg, cutting three railroads, two canals, telegraph wires, destroying supplies, and leaving only one line of railroad by which supplies could be brought to Lee's army. During this raid he defeated Early again at Waynesborough (q.v.). At Five Forks (q.v.) 1 April Sheridan turned Lee's flank, forcing him to evacuate Petersburg and begin the retreat to Appomattox. In the pursuit of Lee Sheridan took a leading part, and when he had placed his army squarely across the Confederate line of march at Appomattox Court House the surrender took place (9 April).

From May 1865 to March 1867 Sheridan commanded the Military Division (later Department) of the Gulf. His strong force on the Mexican border encouraged the Liberals and forced the French to withdraw their support from Maximilian. In his 'Personal Memoirs' Sheridan states that material assistance was secretly given by the United States authorities to the Liberal army under Juarez, 30,000 muskets at one time being sent to the latter from the United States arsenal at Baton Rouge. After the passage of the reconstruction acts, in March 1867, Sheridan was placed in command of the Fifth Military District, consisting of Louisiana and Texas, with headquarters at New Orleans. His career as military governor was a stormy one. He was in favor of radical measures in dealing with the conquered Southerners, and in the troubles that arose in his district he was supported by General Grant and opposed by President Johnson, who sent several messengers to him in the endeavor to influence him to a more moderate course. Sheridan, believing that severe measures were necessary, refused to conform to the suggestions of the President's agents, and Johnson, after Sheridan's wholesale removal of civil officers, relieved him from command of the Fifth Military District in September 1867. General Grant strenuously protested, but Johnson was firm, and Sheridan was transferred to the Department of the Missouri. In 1869, when General Grant became President, Sheridan was made lieutenant-general. In 1870-1 he was with the German armies observing the campaigns of the Franco-German war; in 1875 was again sent to New Orleans on account of the political riots in that city; in 1878 commanded the Western and Southwestern Military Divisions; in 1883 succeeded Sherman as commander-in-chief of the army; and in 1888 was made general. In person, General Sheridan was short and stout, with rather harsh features. In manner he was gruff, but not unkind. He was trusted by his soldiers,

Digitized by Google

GENERAL P. H. SHERIDAN.

Digitized by Google

Digitized by Google

who called him "Little Phil" and believed him invincible. He married, in 1879, Miss Rucker, daughter of General D. H. Rucker of the United States army. In religion, General Sheridan was a devout Roman Catholic. He always refused to enter politics.

Consult: Sheridan, 'Personal Memoirs' (1888); Davies, 'General Sheridan' (1895); Newhall, 'With General Sheridan in Lee's Last Campaign' (1866).

WALTER L. FLEMING,
Professor of History, West Virginia University.

Sheridan, Richard Brinsley, English dramatist, orator, and statesman: b. Dublin, Ireland, 30 October 1751; d. London, 7 July 1816. His father, Thomas Sheridan, was an actor; his mother was a dramatist and novelist. At the age of seven he was taken to London. From 1762 to 1768 he attended Harrow school, where, in collaboration with a fellow-pupil named Halhed, he wrote a farce called 'Jupiter.' In 1771 he moved to Bath, where he learned at first hand the foibles of the fashionable world. Among the people that he met was the eminent composer, Thomas Linley. Linley's daughter, well-known as a singer, was a lovely and coquettish girl with many admirers. To shield her from the persecutions of a Major Mathews, Sheridan arranged to escort her to a French convent. Near Calais he became secretly married to her: his age was 21 and hers 18. Linley brought them back to Bath and separated them. After his return, Sheridan fought two duels with Mathews, disarming his opponent the first time and being himself seriously wounded the second. On 13 April 1773, he married Miss Linley openly.

At a very early age he began writing for the theatre. On 17 January 1775, his farce-comedy, 'The Rivals,' was produced at Covent Garden. It failed and was withdrawn. In a revised form it reappeared on 28 January, and is still being played. His farce, 'Saint Patrick's Day,' was first acted on 2 May 1775. It was followed on 21 Nov. 1775, by 'The Duenna,' a comic-opera, whose great success eclipsed the popularity of Gay's 'Beggar's Opera.' In 1776 he succeeded Garrick as manager of the Theatre Royal, Drury Lane. He was careless in business, but his personal popularity atoned for his practical shortcomings. He produced a revision of Vanbrugh's 'Relapse,' called 'A Trip to Scarborough,' 24 Feb. 1777. On 8 May 1777, he presented at Drury Lane one of the greatest comedies of all time, 'The School for Scandal.' He was then only 25. A farce called 'The Critic,' in which he satirized his jealous rival, Cumberland, was performed 29 Oct. 1779. This practically closed his career as a dramatist; though on 24 May 1799, he produced 'Pizarro,' a melodrama adapted from the German of Kotzebue.

His gaiety and talent made him a great favorite in society. On 12 Sept. 1780 he was elected to the Commons for Stafford, and began a remarkable parliamentary career. He developed wondrous power as an orator, and was unexcelled for brilliancy and eloquence. He was conspicuous in the impeachment of Warren Hastings. On 7 Feb. 1787 his great speech before the House of Commons, relating to the Princesses of Oude, held his auditors enthralled for five hours and a half. Hardly less effective was his speech at the arraignment of Hastings in Westminster Hall, June 1788. Throughout his public career he maintained the reputation of a pure and independent statesman.

His wife died 1792; and on 27 April 1795 he married Esther Jane Ogle. His income from Drury Lane averaged £10,000; but he often overdrew his resources to lead a dazzling social life. From 1791 to 1794 the Theatre Royal was rebuilt at ruinous expense to Sheridan; and the destruction of the new house by fire in 1809 involved him in serious financial difficulties. In 1812 he failed of re-election to Parliament; and in August 1813 he was arrested for debt. His health, weakened by social dissipations, failed rapidly; and he died almost in want. He was buried in Westminster Abbey. Consult Fraser Rae, 'Sheridan, a Biography'; and Brander Matthews, 'Introduction to Sheridan's Comedies.'

CLAYTON HAMILTON,
Sometime Tutor in English, Columbia University.

Sheridan, Thomas, Irish clergyman, grandfather of Richard B. Sheridan (q.v.): b. County Cavan, Ireland, about 1684; d. Dublin, Ireland, 10 Sept. 1738. He was educated at Trinity College, Dublin; was at one time chaplain to the lord lieutenant, and later secured a living through Dean Swift, of whom he was a close friend. He was noted for his wit and his gay carelessness, though his extravagance had reduced him to direst poverty. He wrote 'The Art of Punning,' translated Persius in prose and Sophocles' 'Philoctetes' in verse. His son THOMAS, elocutionist, father of Richard B. Sheridan, the dramatist (q.v.): b. near Dublin, Ireland, 1721; d. Margate, Kent, 14 Aug. 1788. He was educated at Trinity College, Dublin, became an actor and theatre manager, and afterward was successful as a lecturer and teacher of elocution. He published: 'Lectures on the Art of Reading' (1775); 'Dictionary of the English Language' (1780); 'Life of Dean Swift' (1784); etc.

Sherif, an Arabic title equivalent to noble. It is borne by the descendants of Mohammed, and descends both in the male and female line. Those who possess this rank are distinguished by green turbans and veils, green being the color of the Prophet. In India they are called Seyyed.

Sheriff, an officer who represents the executive power of a county in the United States, and is elected either by the legislature or the citizens. The requirements are controlled by statute, but usually they are that the person so elected must be over 21, a citizen of the United States, and a resident of the county that he represents. Power to fill a vacancy occurring in the office of sheriff is regulated by statute. The sheriff is required to take a prescribed oath in order to qualify, and to furnish a bond for the faithful discharge of the duties of his office. The sheriff in person or by deputy executes civil and criminal process throughout the county; has charge of the prisoners, attends court, and keeps the peace. His judicial authority is generally confined to ascertaining damages on writs of inquiry. He is not liable for any errors in acting in a judicial capacity—the office is almost exclusively ministerial. A sheriff has the right,

Digitized by Google

when it is reasonably necessary, to lawfully summon any citizen for assistance in the execution of his duty, and one failing to obey the summons is liable to indictment; he has also the right to appoint general or special deputies in such manner as may be prescribed by his jurisdiction; but the sheriff cannot delegate his authority to appoint a deputy. The sheriff is liable for all damages caused by any wrongful act of his office, and may be criminally liable for a wilful breach of his duty, if a corrupt motive is shown. A sheriff's sale is one conducted by a sheriff, or by a person by him deputized, of property held under proper authority.

Sherlock, shėr'lŏk, **Charles Reginald,** American author and journalist: b. Montrose, Pa., 12 May 1857. He began newspaper work in 1876 on the 'Syracuse Courier' and in 1883–4 he was city editor of the 'Albany Journal.' From 1887–1900 he was editor of the 'Syracuse Standard.' He has published 'Your Uncle Lew' (1901); 'The Red Anvil' (1902).

Sherlock, Thomas, English prelate: b. London, England, 1678; d. there 18 July 1761. He was educated at Cambridge, was appointed Master of the Temple in 1704, vice-chancellor of the university in 1714, and Dean of Chichester in 1716, after which he entered into a controversy with Bishop Hoadly, in defense of the corporation and test acts. In 1728 he was appointed to the see of Bangor, and in 1734 translated to that of Salisbury. He was offered the primacy on the decease of Archbishop Potter, in 1747, but he refused it; and the following year was translated to the see of London, where he remained till his death. He was noted for his eloquence as a preacher, his sermons long being considered models of pulpit eloquence; and of his celebrated controversial works on Christian evidences may be mentioned: 'The Use and Intent of Prophecy' (1725); and 'Tryal of the Witnesses of the Resurrection of Jesus' (1729). His 'Discourses at the Temple Church' were published in four volumes (1754–8) and his 'Works' were edited by Hughes (5 vols., 1830).

Sherlock Holmes, Adventures of, a collection of stories by A. Conan Doyle (q.v.), in each of which Holmes figures as a scientific amateur detective of remarkable skill. He is enslaved to cocaine and in manner is brusque and eccentric; but by a method of *a posteriori* reasoning, applied to apparently unimportant facts of common life, he is enabled to uncover most remote and disconnected causes. The 12 tales are full of bizarre and often grewsome details.

Sherman, shėr'man, **Frank Dempster,** American poet: b. Peekskill, N. Y., 6 May 1860. He was graduated from Columbia in 1884 and subsequently studied at Harvard. For many years he has been an adjunct professor of architecture at Columbia. He has published: 'Madrigals and Catches' (1887); 'Lyrics for a Lute' (1890); 'New Waggings of Old Tales' with John Kendrick Bangs (1887); 'Little Folk Lyrics' (1892); etc.

Sherman, John, American statesman: b. Lancaster, Ohio, 10 May 1823; d. Washington, D. C., 22 Oct. 1900. He was the 8th child in a family of 11, being the junior by three years of his brother Gen. William Tecumseh Sherman (q.v.). After having secured an irregular and not very complete general education, he studied law and was admitted to the bar at 21. In 1848 he was a delegate to the National Whig convention at Philadelphia. He was president of the first Republican convention in Ohio, held at Columbus, 13 July 1855, which nominated Salmon P. Chase for governor. In 1855 he was elected a member of the 34th Congress. He took a prominent part in the proceedings of the House; was on the Committee of Inquiry sent to Kansas. He was prominently identified with the support of all measures for the prosecution of the Civil War; defended the protective tariff, and the refunding of the National debt. He was a member of the committee that visited Louisiana to supervise the counting of the returns of that State, and a member of the Electoral Commission. In Congress Mr. Sherman quickly demonstrated his exceptional power as a master of finance. He watched carefully the appropriation bills, speedily extended the credit of the government, and provided for its future support. When Salmon P. Chase resigned the U. S. senatorship from Ohio to enter the cabinet of President Lincoln as secretary of the treasury, Mr. Sherman was elected his successor and took his seat 4 March 1861. In 1881 he was re-elected to the senate, where he remained until 1897 when he was appointed Secretary of State by President McKinley. He resigned that office however, in 1898, on account of failing health. He was a candidate for the Presidential nomination in 1884 and 1888. Among his publications are: 'Selected Speeches and Reports on Finance and Taxation' (1879); and 'Recollections of Forty Years in the House, Senate, and Cabinet' (1893). From 1860 to 1900, there was scarcely a great financial measure with which the name of John Sherman was not connected. Among these were, the making of United States treasury notes legal tender, the enacting of the national banking bill, the refunding act of 1870, and the resumption of specie payments. The detailed record of measures by which the legal tender notes of the government reached par, and by which specie resumption became an accomplished fact at the time fixed for it, exhibits the man under whose leadership this was done as a financier of the highest order.

Sherman, Roger, American legislator: b. Newton, Mass., 19 April 1721; d. New Haven, Conn., 23 July 1793. He was apprenticed to a shoemaker when a child, but in 1743 he removed to New Milford, Conn., where he was engaged with his brother in keeping a small store. He studied law, politics, and mathematics without a teacher, was appointed surveyor for his county in 1745 and for several years made the astronomical observations for an almanac published in New York. In 1754 he was admitted to the bar, served for several terms in the provincial assembly, and in 1761 removed to New Haven, Conn. He became judge of the court of common pleas there in 1765 and served in that position and as judge of the superior court for 23 years. He was assistant governor in 1766–85, treasurer of Yale College in 1766–76, and a member of Congress from 1774–91, when he was elected senator in which capacity he served the remainder of his life. He was one of the committee of five to draft the Declaration of Independence which he afterward signed, was an active member of various war and ordnance com-

Digitized by Google

mittees, served on the treasury board and in 1777 was one of the framers of the original Articles of Confederation. He assisted in the codification of the laws of Connecticut, was a delegate to the Federal Constitutional Convention in 1787, where he played a prominent part, and from 1784 until his death was mayor of New Haven.

Sherman, Thomas West, American military officer: b. Newport, R. I., 26 March 1813; d. there 16 March 1879. He was graduated from the United States Military Academy in 1836 and six years later served in Florida against the Indians. He was in command of a battery at Buena Vista during the Mexican War, and for his bravery and excellent service was brevetted major, 1847. He also commanded the land forces in the expedition against Port Royal 1861-2. As a result of injuries received at Port Hudson, La., 1863, he was given leave of absence until 1864 when he took command of an artillery division in the Department of the Gulf. He was retired as major-general 31 Dec. 1870.

Sherman, William Tecumseh: b. Lancaster, Ohio, 8 Feb. 1820; d. New York 14 Feb. 1891; son of Judge Charles R. Sherman. His father died when he was about nine years old, and he was brought up in the family of Hon. Thomas Ewing, who procured for him an appointment as cadet at the United States Military Academy, West Point. He is described as having been at the time a tall, slim, loose-jointed lad, with red hair, fair, burned skin, and piercing black eyes. In July 1840 he graduated from the academy, and was appointed 2d lieutenant in the Third Artillery, and 1st lieutenant Nov. 1841. He served in Florida until 1842, and was afterward in garrison at Fort Moultrie, S. C. At the first rumor of war with Mexico he showed great impatience to be sent to Texas, but the war department, instead, ordered him to California. The voyage appears to have made him strongly in favor of an interoceanic canal. He served in California, as acting assistant adjutant-general of the department, until Feb. 1849, when he was transferred to similar duty on the staff of Gen. Persifor F. Smith, who commanded the division of the Pacific. Having been ordered to New York as bearer of despatches, he was married in January 1850, to Ellen Boyle, daughter of his foster-father, Hon. Thomas Ewing, then Secretary of the Interior.

In September 1850, Sherman was transferred to the commissary department with the rank of captain, and stationed at Saint Louis and New Orleans. Shortly after his arrival at New Orleans he received notice of his appointment as partner in the banking firm of Lucas & Turner, a branch of Lucas & Simonds, of Saint Louis, and, feeling that he could do better in business than in the army, obtained a six months' leave of absence, and started for California to represent the house. When the leave of absence expired he resigned his place in the army. Sherman at this time saw the danger of the slavery issue. «Unless people both North and South,» he wrote in August 1856, «learn more moderation, we'll see sights in the way of civil war.»

Sherman removed to New York in 1857, and to Leavenworth, Kan., in 1858, where he practised law until July 1859, when he was elected superintendent of the proposed military academy in Louisiana. The institution was opened 1 Jan. 1860, as the Louisiana State Seminary of Learning and Military Academy, and Sherman remained its superintendent until 18 Jan. 1861, when he wrote to the governor asking to be relieved the moment the State determined to secede. His request having been granted, he went to Saint Louis in February 1861, and was for a short time president of a Saint Louis railroad company. While holding this place he was deeply interested in the approach of the struggle between North and South, making valuable suggestions, some of which were shown by his brother, John Sherman, then in Congress, to Secretary of War Cameron. «On the necessity of maintaining a government, and that government the old constitutional one,» he declared, «I have never wavered, but I do recoil from a war when the negro is the only question.»

In May 1861, Sherman was appointed colonel of the 13th regular infantry, and 30 June he assumed command of a brigade of McDowell's army. He took an honorable part in the first battle of Bull Run; on 3 August received his commission as brigadier-general of volunteers, dating from 17 May, and 24 August was ordered to duty in the Department of the Cumberland, under Gen. Robert Anderson, whom he succeeded in command of the department 8 October. On the 26th of the same month he wrote that «to accomplish the only purpose for which Kentucky can be used there should be a force here of 200,000 men.» In November Gen. Sherman, who was severely criticized by many for his assertions as to the number of men needed for the war in his section, was relieved from his command and sent to Missouri. After a short leave home he was employed for a time as commander of the camp of instruction at Benton Barracks, near Saint Louis. In February 1862, he was transferred to Paducah, Ky., where he organized the division which he subsequently commanded at Shiloh. In this hard-fought, two days' conflict Sherman was severely wounded, and Gen. Grant declared that «to his individual efforts I am indebted for the success of that battle.» Gen. Sherman was commissioned major-general of volunteers, 1 May, and in the same month compelled the Confederates to evacuate Corinth, which was followed, in July, by the occupation of Memphis. His campaign against Vicksburg proved unfortunate. He was defeated and driven back at Chickasaw Bayou, but afterward rendered effective aid to Gen. Grant in the operations which resulted in the surrender of Vicksburg.

Gen. Sherman was made a brigadier-general of the regular army in July 1863. After the fall of Vicksburg and Port Hudson the Western armies lay comparatively idle for a time, and early in the autumn Gen. Sherman was occupied in rebuilding the Memphis & Charleston railroad to the East, that the armies might draw supplies by that route. While engaged on this work he was ordered to cross the Tennessee and march eastward. The battle of Chattanooga, in which Sherman distinguished himself, followed, and he was next sent to the relief of Burnside, besieged by the Confederates in Knoxville. Sherman forced Longstreet to raise the siege 5 Dec. 1863. After a few weeks in winter quarters in northern Alabama, Sherman, in January 1864,

Digitized by Google

made a raid across the State of Mississippi from Jackson to Meridian and back again, doing a vast amount of damage to railways, Confederate property, and the country at large.

Gen. Grant being invited to take unhampered command of the military forces of the United States, and to repeat, if possible, in the East, the successes which had attended his career in the West, assigned Sherman to the command of the Military Division of the Mississippi, including the Departments of the Ohio, the Tennessee, the Cumberland, and the Arkansas, with temporary headquarters at Nashville, and with orders to move on Atlanta. With an army of about 100,000 men Gen. Sherman invaded Georgia. He was opposed by Gen. Joseph E. Johnston, with about 45,000 Confederates in excellent spirit and discipline, but poorly provided with munitions of war, as compared with the Union forces. Johnston engaged Sherman's army at Dalton, Resaca, Cassville, Dallas and Kenesaw Mountain. At the last named place, 27 June, the Confederates, owing to the shortness of artillery ammunition, reserved their cannon for the final charge of the Union troops, receiving them with a destructive fire which won the day for the South.

Sherman's progress, however, could not be stayed, and the Richmond government, believing that Johnston was not doing all that could be done with the men at his command, relieved him and put Hood in his place. Sharp battles followed in the vicinity of Atlanta, and at length Hood was compelled to evacuate the city during the night of 1 September. Gen. Sherman issued an order that all the inhabitants should leave Atlanta, going North or South as they saw fit, and offering transportation to that end. Mayor Calhoun and other citizens appealed in vain to have the order recalled. «You cannot qualify war in harsher terms than I will,» answered Gen. Sherman, «war is cruelty and you cannot refine it.» The order was carried out, and approved by the authorities at Washington. Gen. Sherman gave as his reasons to his military superiors that he wanted all the houses for military and storage purposes, and did not wish to be burdened with the care of the inhabitants.

General Sherman became convinced, after a series of indecisive operations against Hood, that the aim of the latter was to draw him out of Georgia. He determined on marching to the sea, cutting a swath of devastation through the heart of the Confederacy, and destroying, as far as possible, the sources of Confederate supplies. Gen. Grant fully approved the plan, and Sherman, after burning Atlanta, breaking up the railway, and sending a part of his army to reinforce Thomas at Nashville, started, with about 70,000 men, on his memorable march. He ordered his troops to forage liberally on the country, and although foraging was supposed to be done by regular details only, it was, in fact, carried on practically without restriction, and the devastation along the line of march was most complete. The Confederates had virtually no force to oppose to Sherman's advance, and when the governors of Alabama, South Carolina, and Georgia were appealed to from Richmond, the first mentioned replied that none but cripples, women and children, and very old men were left in the State. Sherman entered Savannah 23 December, having lost on his march from Atlanta, 103 killed, 428 wounded, and 278 missing. Congress, 10 Jan. 1865, tendered the thanks of the people of the United States to Gen. Sherman and his command. Sherman moved northward 1 February and occupied Columbia 17 February, the place being destroyed by a conflagration for which Gen. Sherman always claimed that he was not responsible.

Gen. Johnston was recalled to command by the chiefs of the sinking Confederacy, and after several desperate encounters, Gens. Sherman and Johnston met at Durham Station, N. C., 18 April. The terms agreed upon were most liberal to the Confederates, allowing them to deposit their arms at their State capitals, and providing for the recognition of their State governments. The terms were made subject to the approval of superior authority, and a suspension of hostilities was agreed upon to obtain that consent, 48 hours' notice to be given by either side before resuming hostilities. Lincoln had been murdered; there was a vindictive feeling toward the South at Washington, and Johnson and his cabinet wholly disapproved Gen. Sherman's arrangement, and ordered Gen. Grant to take charge of Sherman's command. Grant, always generous in his recognition of Sherman's merits, went to Raleigh, as directed, but left to Sherman the honor of receiving Johnston's surrender on the same terms as granted to Lee. Sherman keenly felt what he regarded as unjust treatment on this occasion by Secretary of War Stanton, and declined publicly to take Stanton's proffered hand at the great army review in Washington 24 May 1865.

Sherman was appointed to command the military division of the Mississippi 27 June 1865; promoted to be lieutenant-general 25 July 1866, and assigned in August to the Military Division of the Missouri. On the accession of Gen. Grant to the Presidency, Sherman succeeded to the command of the army as general. About this time he wrote: «I do think some political power might be given to the young men who served in the rebel army, for they are a better class than the adventurers who have gone South purely for office.» Gen. Sherman retired 8 Feb. 1884, taking, to the last, an active interest in public affairs. A splendid equestrian statue, by Saint Gaudens, presenting Gen. Sherman in characteristic attitude, as when he rode at the head of his army, was unveiled at the southeastern entrance of Central Park, New York, in 1903, and another handsome equestrian statue of the great General was dedicated in Washington the same year, President Roosevelt taking part in the ceremonies. The Washington statue stands on the spot whence Sherman reviewed the grand march of the Union army in 1865.

HENRY MANN.

Sherman, Texas, city, county-seat of Grayson County; on the Atchison, T. & S. F., the Houston & T. C., the Missouri, K. & T., the Saint Louis S. W., and the Texas & P. R.R.'s; about 64 miles north of Dallas and 12 miles south of the Red River. It is in the Red River Valley, about 1,000 feet above the sea. It is in a fertile agricultural region, a large portion of which ships its extensive cotton and grain products through Sherman. The great Ardmore coal fields, in Indian Territory, are about 48 miles northwest. It has a cotton gin the original cost of which was $250,000 several large cottonseed-

Digitized by Google

oil mills, flour mills, lumber mills, machine shops, brick works, foundries, broom and mattress factories, furniture factories, carriage and wagon works, bag factory, and marble works. It has an extensive trade in corn, wheat, fruit, cotton products, marble, and manufactured articles. The principal public buildings are a government building, county court-house, municipal buildings, several of the business blocks, the churches and schools. There are eight churches, the North Texas Female College (M.E.), the Sherman Institute, the Austin College for Boys (Presbyterian), Saint Joseph's Academy (R.C.), the Fred Douglass High School for colored pupils, a commercial college, public and parish elementary schools, and a public library. The two banks have a combined capital of $900,000. Pop. (1910) 12,412.

Sherman Act, an act of the United States Congress, approved 14 July 1890. It was the culmination of a long disagreement between the two Houses over a financial policy, neither side being disposed to yield. This bill was supported by Senator Sherman and others as a compromise measure. It instructed the Secretary of the Treasury to buy silver bullion to the amount of 4,500,000 ounces a month, and to issue treasury notes in payment. Though the bill was approved, the financial policy continued to be a disturbing question and arguments favoring a repeal were presented at almost every opportunity. The business depression of the summer of 1893 was alleged to be a consequence of the bill, and President Cleveland summoned Congress to convene in special session, 7 August. A bill to repeal the silver-purchasing proviso of the Sherman Act passed the House 28 August. In the Senate, the Voorhees bill was presented as a substitute, its provisions being a repeal of the silver-purchasing clause, but affirming bimetallism as a National policy. After a protracted contest the Voorhees bill passed the Senate 30 October. It was concurred in by the House 1 November, and the President approved it the same day.

Sherry, a favorite Spanish wine, so called because chiefly produced in the neighborhood of Cheres, near Cadiz, in Andalusia, Spain. Unlike many of the French wines, the manufacture of sherry is carried on chiefly by a few large concerns. The industry has principally passed to French and British proprietors, who have greatly improved the manufacture and have bettered the grade of commercial sherries. The best soil consists chiefly of carbonate of lime, with a small admixture of silex and clay, and occasionally magnesia. Red and white grapes are used indiscriminately. When ripe and gathered they are spread on mats, and left to dry for two or three days; they are then freed from the stalks, and the rotten or unripe berries rejected. Being now introduced into vats, with a layer of burned gypsum on the surface, they are trodden by peasants with wooden shoes. The juice is collected in casks, in which the fermentation is allowed to take place, continuing generally from October till the beginning or middle of December. The wines are then racked from the lees, and those intended for exportation receive additions of brandy, seldom more than 3 or 4 gallons to the butt. The new wine is harsh and fiery, but mellows by being allowed to remain in the wood 4 or 5 years, though 15 or 20 years are required to perfect its flavor. Sometimes bitter almonds are infused to give the wine a nutty flavor. The dry sherry, that which is least sweet, is the most esteemed. The finest variety of sherry is the Manzanilla sherry, the excellent qualities of which are determined by the nature of the soil and the lie of the district in which it is grown; Amontillado and Montilla sherries and Vino de Pasta are also highly esteemed. The sherry wines are shipped for the most part at Cadiz, and are principally exported to England. No wine is more largely imitated and adulterated than sherry.

Sherwood, shĕr'wŭd, **Katharine Margaret Brownlee**, American writer: b. Poland, Ohio, 24 Sept. 1841. She was married to I. M. Sherwood in 1859, was editor of the woman's department of the 'National Tribune' (1883–98), has been active in women's clubs and is president of the Ohio Newspaper Women's Association. She has published 'Campfire and Memorial Poems'; 'The Dream of the Ages.'

Sherwood, Margaret Pollock, American author and educator: b. Ballston, N. Y., 1 Nov. 1864. She was graduated from Vassar College in 1886 and since 1898 has been associate professor of English literature at Wellesley College. She has published 'An Experiment in Altruism' (1895); 'A Puritan Bohemia' (1896); 'Dryden's Dramatic Theory and Practice' (1898); 'Henry Washington, Idealist' (1899).

Sherwood, Mary Elizabeth Wilson, American author: b. Keen, N. H., 1830; d. New York 12 Sept. 1903. She was the daughter of General James Wilson, member of Congress from New Hampshire, and when 17 was left in care of a large family by her mother's death. Gifted with great beauty and intelligence she won much admiration at the capital and numbered among her friends such men as Bancroft, Bryant, Motley, and Prescott. She was married to John Sherwood, a lawyer of Washington. She engaged in literary work, traveled extensively in Europe, and was actively engaged in various charitable enterprises. Her publications include: 'The Sarcasm of Destiny' (1877); 'A Transplanted Rose' (1882); 'Royal Girls and Royal Courts' (1887); 'Sweet Brier' (1889); etc., besides numerous poems signed under "M. E. W. S."

Sherwood, Mary Martha Butt, English author: b. Stanford, Worcestershire, 6 May 1775; d. Twickenham, Middlesex, 22 Sept. 1851. In 1803 she was married to her cousin Henry (afterward Captain) Sherwood, and went with him to India, returning in 1818. Her first book, 'Traditions,' was written when she was 17. Her 'Susan Grey' (1802) was one of the first attempts to write on religious subjects for the poor, and for many years her various writings were extremely popular in religious circles. Of her 90 religious works and stories the best remembered are: 'The Little Woodman'; 'Little Henry and His Bearer'; 'Fairchild Family'; 'The Lady of the Manor.'

Sherwood, Rosina Emmett, American artist: b. New York 1857. She was the pupil of William Chase in her native city, and afterward studied at Paris in the Julien Academy. A silver medal was awarded to her at the Paris Exposition of 1889 and a medal at the Columbian Exposition of 1893. She is a member of the Society of American Artists, of the New York

Digitized by Google

Water Color Society and of the American Water Color Society. Her work as an illustrator has attracted wide attention.

Sherwood Forest, an ancient forest in Nottinghamshire, England, in a hilly district between Nottingham and Worksop. The tract covered about 200 square miles and was formerly a royal forest, famous as the scene of the exploits of Robin Hood and his merry men, many legends of whom are yet to be heard in the surrounding country. Only a small portion of the forest, near Rotterham, still remains. The rest of the country it once covered is now occupied by country-seats and private parks, and is for the most part bare of trees.

Shet'land, Scotland, a county embracing the group of islands northeast of Orkney, of which 20 are inhabited. They contain 566 square miles, and the largest are Mainland, Yell, Unst, Fetlar, Bressay, Whalsay and Foula. Mainland contains about two thirds of the entire acreage; its surface is hilly with indented coast line and interspersed by numerous lochs. Ronas Hill (1,475 feet) is the highest point in the northwest of Mainland: The Sneug (1,372 feet), in Foula, is next in height. The coasts of the whole group are bold and rocky, presenting some fine landscape. Peat moss covers much of the surface, and some cereal crops and vegetables are grown. The pastures cover about 43,000 acres. Domestic animals are reared — the small Shetland ponies are well known — but the chief industry consists in the herring fisheries. The manufactures are mainly woolens. Lerwick, on Brassey Sound, is the capital; and Scalloway the largest village,— both in Mainland. The exports are fish, oil, cattle, horses, eggs and gloves. There are 61 public schools, church schools and several schools for superior education. The inhabitants are of Norse extraction and were for several centuries under Scandinavian sovereigns. Since 1468 they have belonged to Scotland. There are numerous antiquities which are highly interesting, including brochs, standing-stones, tumuli, and the ruins of a Roman camp on Fetlar Island. Pop. about 31,000.

Shewbread, shō'brĕd, the 12 unleavened loaves placed upon a table in the outer department of the Jewish sanctuary. The number 12 represented the 12 tribes. The loaves were placed in two piles, one above another, and were changed every sabbath day by the priests. The removed bread became the property of the priests, who alone had a right to eat of it, and only in the holy place. In cases of emergency, however, they incurred no blame by giving it to persons who were in a state of ceremonial purity, as in the instance of David and his men (1 Sam. xxi. 4-6; Matt. xii. 4).

Shiahs, shē'ạs. See Religious Sects; Shiites.

Shib'boleth, a word which on a certain occasion served as a test to distinguish Ephraimites from Gibeonites. Jephtha's men, Gibeonites, held the ford of Jordan, with orders to suffer no Ephraimite to cross over. When challenged with the question «Art thou an Ephraimite?» the man of Ephraim would answer «Nay.» «Say now Shibboleth»; and the other pronounced it «Sibboleth,» «for he could not frame to pronounce it right.» In the Septuagint version, which is followed by the Latin Vulgate, the «point» of the question is completely lost: «Art thou not an Ephraimite?» and they said «Nay.» And they said to him, «Then say *stachys*,» that is, «say ear» (of corn), which is the etymological meaning of the Hebrew word shibboleth: «and he framed not to speak so.»

Shield, shēld, **William**, English composer: b. Swalwall, Durham, 5 March 1748; d. London 25 Jan. 1829. He early studied music and composed anthems that were sung in Durham cathedral. His earliest sustained work was a comic opera, 'The Flitch of Bacon' (1778), and having been appointed composer to Covent Garden (1778-97) he produced several other works, including 'Rosina' (1783); 'The Poor Soldier' (1784); 'The Woodman' (1792); 'Two Faces Under a Hood' (1807). But he is best known by his songs, among which are 'The Heaving of the Lead'; 'The Arethusa'; 'The Thorn'; 'The Ploughboy'; and 'The Wolf.' The tune of 'Auld Lang Syne,' as now sung, was introduced into his 'Rosina'; the authorship of 'Coming through the Rye' has also been claimed for Shield. Among his literary works are: 'An Introduction to Harmony' (1817); and 'Rudiments of Thorough Bass.' His musical productions comprise several collections of glees, ballads, trios, etc.

Shield, a plate or framework of various shapes and materials, and variously covered and adorned, formerly in extensive use among almost all peoples and still used by savage tribes. The shield is of very great antiquity. The spearmen of ancient Egypt used rectangular shields with a semicircular top. These shields were about half the soldier's height, and were generally covered with bull's hide, having the hair outward. Occasionally they were strengthened by studs and rims of metal. The larger kinds were strapped across the shoulders by a thong, but the smaller bucklers had wooden bars enabling them to be grasped by the hand. The shields of the warriors in the Iliad were of untanned hide and metal, large enough to cover the whole man, and, when not in use, were supported on the warrior's back by means of a leather belt. Many of them bore ornamental and other devices, but in some cases the devices described are evidently elaborated by the poet for special purposes. The shields of later Grecian times were smaller than those of the heroic age. The «clipeus,» circular in some cases, and in others oval, was used in Greece and in early Rome, but only by the higher class of Roman soldiers, and it was soon altogether abandoned by the Romans in favor of the Sabine shield known as the «scutum.» The scutum was of wood or wicker-work, either rectangular or oval in shape, and often curved. According to Polybius it was 4 feet long by 2½ broad, or rather larger. The shields of the early Franks, the Scandinavians, and the Anglo-Saxons were round. That of the Anglo-Saxons was of wood covered with leather, and had a prominent central boss. The shield of the Normans at the period of the Conquest was large, kite-shaped, and elaborately adorned. In later times this gave place to smaller, though still triangular forms, but with the introduction of firearms shields were abandoned as useless, except by the Scottish Highlanders, who made

Digitized by Google

good use of them in the last Stuart rebellion, and by savage and semi-savage tribes.

Shields, shēldz, **Charles Woodruff**, American educator: b. New Albany, Ind., 4 April 1825; d. Newport, R. I., 26 Aug. 1904. He was graduated from Princeton in 1844, from the Theological Seminary there in 1847, was ordained in the Presbyterian ministry and served in charge of pastorates at Hempstead, L. I., in 1849–50, and in Philadelphia in 1860–65. He later occupied the chair of harmony of science and revealed religion at Princeton. His publications include: 'The Presbyterian Book of Common Prayer according to the Revision of the Westminster Divines' (1864); 'Religion and Science in Relation to Philosophy' (1875); 'The Order of the Sciences' (1882); 'The United Church of the United States' (1896); 'The Scientific Evidences of Revealed Religion' (1900); etc.

Shields, James, American military officer: b. Dungannon, Ireland, 1810; d. Ottumwa, Iowa, 1 June 1879. He came to the United States in 1826 and entering the army subsequently served through the Mexican War and for bravery in the battles of Cerro Gordo and Chapultepec was brevetted major-general. He was United States Senator from Illinois in 1849 and from Minnesota in 1857. During the Civil War he especially distinguished himself by defeating «Stonewall» Jackson at Winchester, 23 March 1862. He was defeated at Port Republic 9 June 1862 and resigned his commission in 1863.

Shields, England, the urban aggregation of North and South Shields, two separate municipalities and important seaports in Northumberland and Durham respectively, on opposite banks of the Tyne, near its mouth in the North Sea. The port of Shields, formed by an expansion of the river into a wide bay, has been greatly improved and deepened by dredging and the construction of piers, and accommodates vessels of any size at their quays. There is a very extensive trade, particularly in coal. The registered shipping of North Shields in 1900 was 69,131 tons; of South Shields, 38,485.

North Shields, on the north bank of the Tyne, forms part of the municipality of Tynemouth (q.v.). It extends about one mile along the river, and consists of an old and a modern portion, the former with narrow streets and lanes, and the latter with spacious streets and squares. The township extends up the river to Willington, and includes Northumberland Dock and Albert Edward Dock. The chief industrial establishments are ship-building yards, saltworks, iron foundries, marine-engine works, and electrical works. Fishing is largely carried on, and much fish is sent to many parts of England.

South Shields, opposite North Shields, communicates with the latter by steam-ferries. The old part of the town consists of long narrow streets running parallel to the river; but the modern part, immediately behind, occupies a higher site and possesses many handsome buildings. The public institutions include a town-hall, police buildings (1893); a custom-house, free library and museum, infirmary, fever hospital, public baths and washhouses; nautical college, national and other schools, and several benevolent endowments. The chief industries are coal-mining and coal shipments, ship-building and ship-repairing, marine-engine and boiler-making, and the manufacture of glass, earthenware, chain-cables, and anchors. Coal is shipped principally at the Tyne dock belonging to the North-Eastern Railway Company. A stone pier a mile long has been constructed at the mouth of the harbor.

Shiites, shē'īts, a sect of Mohammedans, so called from the Arab word «shiah,» meaning a sect. The Shiites believe that Ali, the son-in-law of Mohammed, was the rightful successor of the prophet, and they accord to him honor hardly second to that paid to Mohammed himself. They assert that the first three caliphs, Abubekir, Omar and Othman, were usurpers, and an essential part of their religious practice is to curse and denounce their memories. As the caliphs named are held in high reverence by the orthodox Mohammedans, the animosity between the latter and the Shiites is of the fiercest character, and has for many centuries been the cause of sanguinary strife, the fact that Ali and his two sons were murdered being made a ground by the Shiites for avenging their deaths as a religious duty. Persia is the stronghold of the Shiites, most of the inhabitants belonging to that sect, which exists also in Central Asia and India, and numbers in all about 18,000,000 persons. See also Religious Sects.

Shikarpur, shĭk-är-poor', India, (1) Capital of a district of the same name, in the Sind Division, Province of Bombay, 150 miles southeast of Khelat and 18 miles west of the Indus River. Owing to its low situation it suffers from frequent inundations. It stands in the midst of orange and date groves, and flourishing orchards. Its buildings are insignificant, excepting perhaps several mosques, the bazaar, and a few private Hindu residences. The trade has always been important, owing to the town's position on the Bolan Pass, connecting India and Khorassan. The manufactures include carpets, muslins, and pottery. The soil is very productive, and yields large crops of grain.

(2) The district of Shikarpur covers an area of 9,296 square miles. Pop. 1,018,237. It is a broad alluvial plain, with a few limestone hills and some salty patches. There is an extensive desert portion and forests along the banks of the Indus. Agriculture, chief crops rice, millet and wheat, is dependent on canals from the Indus.

Shilka, shĭl'kä, Asia, in eastern Siberia, rises in the Trans-Baikal region, among the Yabloni Mountains, and is one of the chief tributaries of the Amur into which it empties at a point beyond Ust Strelka. It is 260 miles long, and navigable about one half of the year, In winter its frozen bed is utilized as a highway. Sryetinsk is an important station on the river for vessels going to Khabarovsk. It is a terminus of the Trans-Siberian Railway, and the starting point of Russian expeditions on the Lower Amur.

Shillaber, shĭl'a-bėr, **Benjamin Penhallow**, «Mrs. Partington,» American humorist: b. Portsmouth, N. H., 12 July 1814; d. Chelsea, Mass., 25 Nov. 1890. After a brief secondary schooling and training in a local printer's office, he went to Boston, where he followed his trade in several newspaper offices; with the interruption of a year's voyage to British Guiana. Then he began journalistic work. Achieving from the first (1847) a great success with his 'Sayings of

Digitized by Google

Mrs. Partington,' whose homely wisdom is closely allied to that of the Widow Bedott. In Boston he was successively an editor of the *Post*, and editor-in-chief of the 'Carpet-Bag,' a humorous publication of short-lived fame, and of the 'Saturday Evening Gazette.' Shillaber's work was not, as one critic has phrased it, "trained to move in literary circles," but in that was similar to most American humor of its period. Among the titles of his books are: 'Rhymes with Reason and without' (1852); 'Life and Sayings of Mrs. Partington' (1853); 'Mrs. Partington's Knitting Work' (1857); 'Partingtonian Patchwork' (1872); and 'Cruises with Captain Bob' (1880).

Shillelagh, shĭ-lā'la, the cudgel carried by the conventional Irishman, with which he is supposed to delight to play on the heads of his friends on occasion. The name is borrowed from the once famous oak forest of Shillelagh in the southwest corner of County Wicklow.

Shilling, the name of an English silver coin and money of account equal to 12 pence, or the 20th part of a sovereign or pound sterling; and equivalent in the United States to about 24⅓ cents. In the United States, a denomination of money formerly in use, differing in value relatively to the dollar in different States, but below that of the English shilling with a corresponding value for the penny and the pound.

Shiloh, shī'lō, Palestine, occupied the summit of a high mountain north of Bethel. The Ark of the Covenant or Tabernacle (q.v.) rested here from the time of Joshua to that of Eli, when it was carried away by the Philistines. Prior to this, Shiloh was the religious seat of the Israelites and a great feast was held annually. The phrase of the Scriptures "until Shiloh come," has received considerable attention from theologians, and its accepted interpretation is — "until Christ come," or "until rest come." A small village site, 20 miles north of Jerusalem, is identified with the ancient Shiloh.

Shiloh, shī'lō (Tenn.), **Battle of.** This engagement, known also as Pittsburg Landing, was fought 6–7 April 1862, between the Union forces of Gen. Grant, commanding the Army of the Tennessee, and of Gen. Buell, commanding the Army of the Ohio — the latter arriving the night of the first day — and the Confederate Army of the Mississippi under Gen. A. Sidney Johnston, with Gen. P. G. T. Beauregard second in command.

After the battles of Mill Springs and Fort Donelson (qq.v.) Gen. Johnston withdrew from Kentucky and Tennessee to the line of the Memphis and Charleston Railroad, and soon after concentrated his army at Corinth, Miss. The Union forces were sent up the Tennessee River under Gen. C. F. Smith, Gen. Grant having been ordered by Gen. Halleck to remain at Fort Henry (q.v.), Gen. W. T. Sherman, commanding the advance, and seeking to cut the railroad, finding the country above Pittsburg Landing under water, fell back to that point, and recommended its occupation to Gen. Smith, who had remained at Savannah. Sherman established his division 19 March at Shiloh Church, about two and a half miles back from the Landing, Gen. Hurlbut's division having been encamped one mile out from the river. Gen. Grant, having been restored to command, reached Savannah 17 March, and sent McClernand's, and C. F. Smith's division under W. H. L. Wallace to Pittsburg. Prentiss' division followed later. Little or no attention was paid to lines of battle or reserves, both Grant and Sherman looking upon the concentration as preparatory to an advance upon Corinth. Gen. Lew Wallace's division was established at Crump's Landing, some six miles below, where, as Grant explained to Halleck, he had a good road which would enable him "to form a junction with the main column, . . . six or seven miles before reaching Corinth."

In regard to this move Gen. Halleck, 20 March, telegraphed: "By all means keep your forces together until you connect with Gen. Buell, and wait till you are properly fortified and receive orders." No attention was paid to this direction as to fortifying, and neither abatis nor rifle-pits were constructed, nor timber felled. Gen. Grant in his 'Memoirs' says of this. "When all reinforcements should have arrived I expected to take the initiative by marching on Corinth, and had no expectation of needing fortifications, though this subject was taken into consideration." The further reason given by Grant was that the proper line for fortifying was in rear of the camps as they ran, and could not be easily supplied with water. Gen. Sherman, in his 'Memoirs,' writes: "We did not fortify our camps against an attack, because we had no orders to do so, and because such a course would have made our raw men timid"; and in a court-martial case he testified: "To have erected fortifications would have been an evidence of weakness, and would have invited an attack." There was no expectation of an attack. Grant, in his 'Memoirs,' says: "The fact is, I regarded the campaign we were engaged in as an offensive one, and had no idea that the enemy would leave strong intrenchments to take the initiative when he knew he would be attacked where he was if he remained." Gen. Nelson, the advance of Buell on the march from Columbia, telegraphed Grant on 3 April that he could be at Savannah 5 April, and in reply was informed Friday, 4 April, that he need not hurry, as boats could not be ready to take him to Pittsburg until the 8th. The same day Grant notified Gen. Prentiss: "The review of your division will not take place until Tuesday next." Two days before the time fixed for review Prentiss and his division were prisoners in the hands of the enemy. This conviction that there would be no attack led not only to neglecting all defensive preparations, but to selecting camp-grounds without regard to a line of battle and chiefly with reference to available ground and the convenience of water. Three of Sherman's brigades were established about Shiloh Church, and the fourth two miles distant. This wide space was later filled in part by Prentiss' division, leaving extensive gaps on each of his flanks. According to maps of both Grant and Sherman, McClernand's division was camped to the left and rear of Sherman, and nearly at right angles to the latter, with its flank toward the enemy's position. Hurlbut's division was a mile in rear of Prentiss, and W. H. L. Wallace's about the same in rear of Sherman.

There had been a considerable show of Confederate cavalry several miles to the front 4 April, but on the 5th Sherman wrote Grant:

Digitized by Google

"All is quiet along my lines now. We are in the act of exchanging cavalry according to your order. The enemy has cavalry in our front, and I think there are two regiments and one battery six miles out." The same day one of his regiments had been engaged under his orders in cutting a road and bridging a creek in his front for the advance on Corinth. Later in the day Sherman wrote Grant: "I have no doubt that nothing will occur to-day more than some picket-firing," and that he did not "apprehend anything like an attack" on his position. The same day, after Sherman's report from the front, Grant, who had gone back to Savannah for the night, telegraphed Halleck: "I have scarcely the faintest idea of an attack (general one) being made upon us, but will be prepared should such a thing take place. Gen. Nelson's division has arrived. The other two of Gen. Buell's column will arrive to-morrow and next day. It is my present intention to send them to Hamburg, some four miles above Pittsburg, when they all get here. From that point to Corinth the road is good, and a junction can be formed with the troops from Pittsburg at almost any point." Grant, the same day, telegraphed Buell: "The enemy at and near Corinth are probably from 60,000 to 80,000."

At the very time of these various interchanges of opinion Hardee's corps was in line of battle within a mile and a half of Sherman's headquarters, having deployed in this position at 10 A.M., 5 April, with Gen. Bragg's corps forming as a second line, and Polk's and Breckinridge's corps, the rear of Johnston's army, closing up. The Confederate army had marched from Corinth the morning of 3 April, expecting to attack Saturday morning, the 5th, but a heavy storm and other causes delayed so that the attack was postponed till Sunday morning, the 6th. Such was the situation Saturday night in the Union camps. While there was a very general feeling among the pickets and many subordinate officers that the enemy was near in considerable force, it was discredited by Gen. Sherman, and so the usual precautionary orders were not given to medical, ordnance, quartermaster, or commissary officers, or to the troops, and no one had any official intimation that a battle was impending, or knew that Johnston's entire army was close to their front awaiting daylight to attack. There had been some strengthening of pickets, but nothing was done which even the suspected presence of the Confederate army would have called for.

Gen. Prentiss, after the war, in the first public utterance on the question of surprise, said: "In reference to the still general inquiry, 'Was our army surprised at Shiloh?' I can only reply for myself that I had not the slightest idea that a general engagement was to be fought that day." He said further: "We were not prepared on the 6th of April"; but "admonished by the action of the enemy on Friday evening," he had strengthened his pickets.

Gen. Andrew Hickenlooper, now one of the principal officers of the Society of the Army of the Tennessee, an officer of note in Grant's army throughout the war, and a strong friend of Grant and Sherman ever after, commanded a battery in Prentiss' division at Shiloh. In the course of an exhaustive review of the battle he says of the general situation: "There had been no order or system in camping; no relation of one command to another; no defined front or known rear, except an impassable river. There was no common directing head or superior officer beyond the rank of division commander placed on the firing line, whom all would recognize and promptly obey." . . . "The night before had been passed by the Union troops in merry-making until the camp sank into a peaceful slumber, from which they were aroused by the roar of musketry and the booming of the guns of the Fifth Battery." As to the early hours of the day of battle, he observes: "The bugle's cheery notes aroused the camp at the dawn of day; breakfast was over, and all was ready for an early morning drill, when the faint reports of distant picket-shots were heard and then came the pattering fire of the reserves, . . . followed by volleys on the right that told of swiftly approaching danger." The pickets of Prentiss were the first to encounter the Confederate advance, and being strongly re-inforced, they attacked Hardee's oncoming line. The latter pushed rapidly forward and thrust strong flanking forces into the wide gaps on Prentiss' flanks, thus turning both, as well as Sherman's left, and the right of Stuart, — Sherman's isolated brigade.

Sherman's brigades formed on their color-line, a portion of the troops being called from their breakfast for the purpose. They advanced between 200 and 300 yards, met the enemy in force, and checked his advance for a time, Sherman meantime sending to McClernand for a battalion of cavalry to join one of his "for the purpose of discovering the strength and design of the enemy." It was not until 8 o'clock, however, that Gen. Sherman became convinced that it was an attack in force. He thus fixes the time in his official report: "About 8 A.M. I saw the glistening bayonets of heavy masses of infantry to our left front in the woods beyond the small stream alluded to, and became satisfied for the first time that the enemy designed a determined attack on our whole camp." At 10 o'clock most of the advanced Union camps were in the hands of the enemy. There had been no time to strike tents or remove stores or private baggage. Sherman relates that two of his horses were killed at the picket-rope, and that he found them still tied there when the camps were recovered the next day.

In spite of this general surprise, and of the tremendous onslaught of solidly formed battle-lines, there was throughout the day much stubborn and even remarkable fighting, in which Sherman, Prentiss, McClernand, and Hurlbut were personally conspicuous. After the battle began, Sherman's conduct was beyond praise. There were probably 20,000 men in regiments that maintained their shattered organizations, and in broken groups, in batteries, and in mixed forces rallied by brave officers and men, which, together, without special regard to lines, held with desperate courage against the enveloping enemy. Many of them were killed or wounded before the day ended. But nothing could permanently resist the well-ordered Confederate movement. Gen. Grant wrote that when he met Buell at the Landing, which was at 1 P.M., "there probably were as many as four or five thousand stragglers lying under cover of the river bluff, panic-stricken, most of whom would

Digitized by Google

have been shot where they lay, without resistance, before they would have taken muskets and marched to the front to protect themselves.»

As the day advanced, the Union line was fast disintegrating. Gen. Sherman, testifying under oath at a subsequent trial, said that «at least 10,000 ran away.» Prentiss' division, fighting till the last, was surrendered and captured soon after 5 P.M., having maintained its organization to the last, and given the best illustration of pluck, endurance, and persistence in fighting that the history of the first day affords. Sherman's organization was destroyed, and he, with a small force of his own, was fighting stubbornly with McClernand, whose organization, though much broken, was still maintained. About 2 P.M. Gen. Johnston was wounded, and died in half an hour. The transfer of command to Gen. Beauregard caused a lull in the fight, and a delay in movement, but at 5 the Union line had been forced back into a corner between the Tennessee River and Snake Creek, an area which included the Landing. Here the line presented a front of about a mile and a half to the enemy. Just as an assault on this position was being delivered at the right of the Confederate lines, Ammen's brigade of Nelson's division of Buell's army, which had marched from Savannah through the swamps, was ferried across the river, and two regiments advanced and opened fire upon the right regiments of the enemy, which, in charging forward, had nearly reached the Landing. The assault was checked without severe fighting, but the arrival of fresh troops thus became known, and the Confederate attack ended for the day. At this time Grant's line in front of the Landing was held by the broken organization of Hurlbut, W. H. L. Wallace, McClernand, and Sherman. There were portions of various organizations available within the protected area, and Lew Wallace arrived during the night with 5,000 men. Buell himself had arrived at 1 P.M., and spent the afternoon in learning conditions and studying the ground, and the night in posting his troops. Nelson's division was ferried over at night, and advanced on the left; Crittenden's, as the steamers brought it from Savannah, was placed on Nelson's right. Two brigades of McCook's division, which followed Crittenden up the river, were established still further to the right. The Union gunboats Tyler and Lexington anchored off the ravine next above the Landing, and near the close of the first day's fight, fired effectively upon the Confederate right flank and front, as the Union line was forced back toward the river. These boats continued their heavy shelling at intervals during the night, to the great discomfiture of the Confederate camps.

The battle of Monday, 7th, was opened under Gen. Buell's orders and direction. His left and centre advanced and became engaged with the enemy's pickets immediately after daylight, and encountered their main line at 6 A.M. McCook's two brigades moved at once into action, and were established still further to the right. The Army of the Ohio pressed steadily forward, and at 4 P.M. had possession of the camps of Stuart, Prentiss, and a part of McClernand's. Two brigades of T. J. Wood's division arrived as the battle was ending, but only one reached the front. The action closed soon after 4, Buell's forces at that time covering two miles of the battle-line (nearly three quarters of it, extending as it did to the left of Lew Wallace's division), and becoming hotly engaged there, in co-operation with Wallace's left regiment. Wallace, at the close of the battle, held the front of the Army of the Tennessee, McClernand, Sherman, and Hurlbut being warmly engaged at the close in connection with the left of Wallace, and the right of McCook. About 5 P.M. the Army of the Tennessee reoccupied its former camps.

When Buell first advanced he was joined by Col. J. M. Tuttle of W. H. L. Wallace's second division, who gathered up about 1,000 men of his own command, rallied many more from fragments about his bivouac, and without orders proceeded to Buell's lines, reported to him, and fought with him through the day. At daylight Grant gave Sherman orders to advance on the right. He thereupon sent his staff officers to collect his men and moved forward about 7 A.M. At 9 o'clock Hurlbut moved under Grant's orders to support McClernand, who, with Sherman, was then engaged near his former camp. Lew Wallace had advanced earlier, and held the right of Grant's army. This division finally swung around upon the ground originally occupied by Gen. Sherman's camps, there coming in contact with the right of McCook of Buell's line. Here the battle ended.

The division commanders of Grant's army were J. A. McClernand, W. H. L. Wallace, Lewis Wallace, S. A. Hurlbut, W. T. Sherman, and B. M. Prentiss. Gen. Buell's divisions on the field were A. McD. McCook, William Nelson, Thomas L. Crittenden, and T. J. Wood. The division commanders of Johnston's army were: of Polk's corps, C. Clark and B. F. Cheatham; of Bragg's corps, D. Ruggles and J. M. Withers; of Hardee's corps, T. C. Hindman, P. R. Cleburne, and S. A. M. Wood; reserve corps, J. C. Breckinridge. The best estimates of strength give Grant 33,000 at the opening of the battle, and Lew Wallace's reinforcement for the second day 5,000. The official reports give Johnston's strength at 39,000 to 40,000. The losses of Grant's army were 1,513 killed, 6,601 wounded, and 2,830 missing; total, 10,944. Buell lost 241 killed, 1,807 wounded, and 55 missing; total, 2,103. Total Union loss, 13,047. The Confederate loss was 1,723 killed, 8,012 wounded, and 959 missing; total, 10,694. Consult: 'Official Records,' Vols. X., LII., Part I.; Grant, 'Personal Memoirs,' Vol. I.; Sherman, 'Memoirs,' Vol. I.; Van Horne, 'History of the Army of the Cumberland,' Vol. I.

H. V. BOYNTON.

Shimoda, shē'mō-dä, or **Simoda,** Japan, a seaport town on the island of Hondo, at the western entrance of the Gulf of Yeddo, 80 miles southwest of Tokyo. It was nearly destroyed by an earthquake and tidal wave in 1854, but was rebuilt, and since 1857, when the Dutch treaty was signed, it has been a free port for foreign commerce. Pop. 5,000.

Shimonoseki, shē-mō-nō-sĕk'ē, or **Akamagaseki,** ä-kạ-mä-ga-sĕk'ē, Japan, a fortified town, railway terminus, and active seaport, at the southernmost point of Hondo, commanding the strait leading from the Inland Sea to the Sea of Japan. The strait at one point only one quarter of a mile wide separates the islands of Hondo

Digitized by Google

and Kiusiu. At Shimonoseki, on 25 June 1863, the American steamer Pembroke was fired upon by the Japanese for attempting to enter the strait, which had been ordered closed by the Mikado; 16 July the United States ship Wyoming destroyed two vessels and attacked the batteries in retaliation; 5 Sept. 1864 a combined squadron of American, British, French, and Dutch ships attacked the forts and destroyed them. The Mikado was forced to pay an immense indemnity to each nation, the United States receiving $785,000. This sum, vastly beyond the real damage, was paid 1864–74. In 1883 it was returned to Japan, but without the interest. The treaty of peace which ended the Chino-Japanese war of 1896 was signed at Shimonoseki April 1895 by Marquis Itô for Japan and Li Hung Chang for China.

Shin-plaster, a bank-note, especially one of a low denomination; a piece of paper money. The term is derived from an old soldier having used a quantity of worthless paper currency as plasters for a wounded leg. See MONEY, PAPER.

Shiner, one of various small silvery fishes of the family *Cyprinidæ,* found in all streams from New England to Kansas and Louisiana, especially in those choked with weeds. They are the object of childish angling expeditions, and sometimes are large enough to be cooked, but should be eaten at once, as the flesh spoils quickly. (See DACE; MINNOW.) The moonfish (*Vomer setipennis*) is sometimes called blunt-nosed shiner.

Shingle, a thin piece of wood, having parallel sides, and thicker at one end than the other, commonly used as a roof covering instead of slates, tiles or metal. To hang out one's shingle means to enter in business and announce that business to the public by erecting a sign. The expression arose from the fact that shingles, in the pioneer days of America, afforded cheap and convenient material for such announcements.

Shingles, a disease (*herpes zoster*) characterized by an eruption of vesicles on an inflamed surface of skin. Their name is derivatively related to *cingle,* a belt or girdle. The eruption consists of red spots and small vesicles which are mostly disposed round one side of the body, like a half belt. In rare cases it encircles the body. It has an obscurely nervous character, occurs in the course of a nerve, and is preceded by stinging neuralgic pains, also by languor, lassitude, loss of appetite, shiverings, headache, nausea, quickened pulse, etc., after which the eruption appears in irregular patches. The vesicles become enlarged to the size of small pearls in 24 to 36 hours, and fresh clusters occur for three or four days, completing the belt-like appearance. As the eruption recedes by the fifth or sixth day, the vesicles become white and opaque, and the red margins become livid or purple. Sometimes the vesicles burst, and several of the patches run together, forming irritable sores, discharging a thin serous fluid, which concretes and forms a crust, that falls off as the parts beneath heal. The disease is not contagious. It is sometimes produced by sudden exposure to cold after violent exercise, and sometimes follows acute affections of the respiratory organs. A similar eruption may appear on the lips and chin in a common cold. The treatment consists in gentle laxatives, and in rectifying any derangement of the system; but the disease must be allowed to run its course, although the irritation can be diminished.

Shinn, Charles Howard, American forester: b. Austin, Texas, 29 April 1852. He was educated at the University of California and at Johns Hopkins University, and was engaged in editorial work 1879–84 on the San Francisco *Bulletin,* the New York *Post, Times, Tribune,* and 'Harper's Weekly.' He was collaborator for California of the United States Division of Forestry, 1899–1900, and in 1902 was appointed head forest ranger of the Department of the Interior. He has published 'Pacific Rural Handbook' (1879); 'Land Laws of Mining Districts' (1884); 'Co-operation on the Pacific Coast' (1888); 'Story of a Mine' (1897); etc.

Shinn, George Wolfe, American Protestant Episcopal clergyman: b. Philadelphia, Pa., 14 Dec. 1839. He was graduated from the Philadelphia Divinity School in 1863, took orders in the Episcopal Church the same year, and after holding various rectorships in Pennsylvania and New York State became rector of Grace Church, Newton, which position he still (1904) holds. He is president of the Boston Chapter of the American Actors' Church Alliance, and his sermons on 'The Stage as a Teacher' and 'The Theatre as a Place of Amusement' have had a wide circulation. He has published: 'Manual of the Prayer Book'; 'Questions About Our Church'; 'Friendly Talks About Marriage'; 'The Episcopal Church'; etc.

Shinn, Milicent Washburn, American author, sister of C. H. Shinn (q.v.): b. Niles, Cal., 15 April 1858. She was graduated from the University of California in 1880 and was editor of the San Francisco 'Commercial Herald' during her last year in college. She edited 'The Overland Monthly' 1883–94, and has published 'Notes on the Development of a Child' (1894–9), since translated into German.

Shinnecock, shĭn'ĕ-kŏk, a bay on the south shore of Long Island (q.v.). It indents Suffolk county for about 12 miles, and at the entrance is a long, narrow sand-bar. Nearby is the land owned by the Shinnecock Indians.

Shinnecock Indians, an Algonquian tribe of Long Island, N. Y., formerly occupying the southern coast from Shinnecock Bay to Montauk peninsula. Many of them early joined the Brothertown Indians, and the 150 that now remain on their reservation of about 400 acres, three miles west of Southampton, have intermarried with negroes until their aboriginal character has been almost obliterated.

Shintoism, shĭn'tō-ĭzm, the primitive religion, or rather cult, of Japan. It has many thousands of gods, the chief deity being Amaterasa, the sun-goddess, from whom the Mikado is said to be descended, and the other gods are supposed to be heroes and ancestors, to whom prayers are addressed, offerings made, and in whose honor dances of a ceremonious and orderly character are held. Shintoism has many priests but no dogmas. It does not teach any moral principles. Its hold on the people is due to its association for many ages past with their ancestral traditions and attachments, and this has prevented it from being wholly superseded by Buddhism, which was for cen-

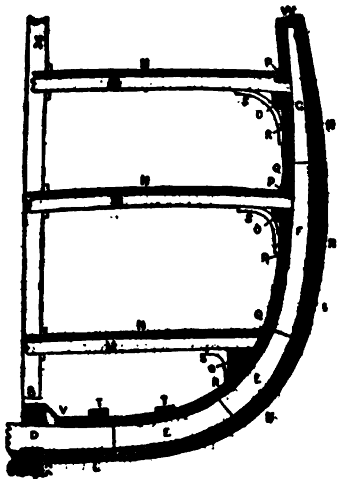
Digitized by Google

turies after its introduction and until a very recent period, the state religion. The Shinto temples are nearly 200,000 in number, as against about 72,000 Buddhist temples, but the large majority of the people are Buddhists. See also BUDDHA; JAPAN; RELIGIOUS SECTS.

Ship. A ship is a large boat, or vessel, intended for navigating the ocean. Technically a ship is a vessel carrying not fewer than three masts rigged with square sails. In the present day ships are of two kinds, sail and steam. For a history of the former see the article SAILING VESSELS, and for a historical sketch of steamships, see the article STEAM VESSELS. A detailed description of vessels used in naval warfare will be found under the title WARSHIPS.

The leading qualities of a ship include stability, capacity, strength, and speed. The stability of a vessel depends on the proportion of her parts and her load and displacement. The displacement of a ship is measured by the volume of water which she displaces when afloat. The weight of this volume of water is of course equal to the entire weight of the ship with her stores and cargo, while its bulk is equal to that of the portion of the ship immersed. The capacity of a ship is her power of carrying stores and cargo, together with crew and passengers. The greater this capacity is in proportion to the size, and the greater the speed of the vessel, the greater is her utility. The more lightly a vessel is built the greater will be her capacity for her size; but the lightness of a vessel is limited by the need of strength to resist strain. Capacity is also to some extent dependent on form, and the form which is most conducive to high speed is not necessarily that which gives the greatest capacity for stowage. The speed of a vessel, as also facility of evolution or promptitude in obeying her helm, depends on the due proportion of her parts.

Construction.— In designing a ship the midship area is reckoned, and a midship section made from which the proportions of the other parts of the ship are calculated. The whole plan of the ship is then drawn in three related sectional plans, called the sheer-plan, the body-plan, and the half-breadth plan. The sheer-plan is a projection on a vertical longitudinal plane dividing the ship into two parts, and gives a complete view of the side, representing the length, depth, rake of the stem and stern, with the wales, water-lines, decks, ports, masts, and channels. The body-plan is a projection of the largest vertical and athwart-ship section, showing the breadth, and having described upon it every timber composing the frame of the ship, those running forward from the place of greatest breadth being described on the right hand, those running aft on the left. The half-breadth plan shows the half-ship lengthwise as seen from above. The water lines are drawn on the sheer-plan as parallel straight lines; they are dotted in or drawn in blue ink on the half-breadth plan, and show the width and horizontal curves of the hull at different levels corresponding with the water lines in the sheer-plan. Half-models of the vessel are also made. These are constructed of thin strips of wood laid horizontally on each other, which represent the parallel water lines, and can be taken apart to serve as models for the full-sized drawing. When the plans are complete full-sized drawings are traced in chalk on the floor of a room called the mold-loft, which is usually of a length equal to half that of the largest ship, in addition to the whole height of her hull. This operation is called laying off the ship. It supplies the workmen with the exact shape and position of that which constitutes what is called the frame of the ship. Pine models are then made of the different parts. The material formerly used in ship construction was timber, but this is now superseded by iron, and iron again is being in many cases replaced by steel. Wood is only now used for the smaller sea-going vessels, coasting craft, and

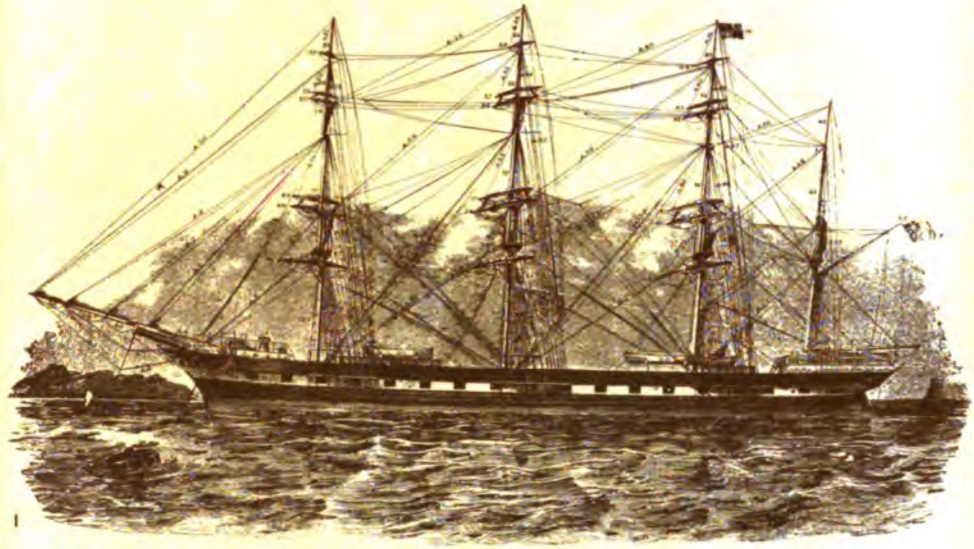


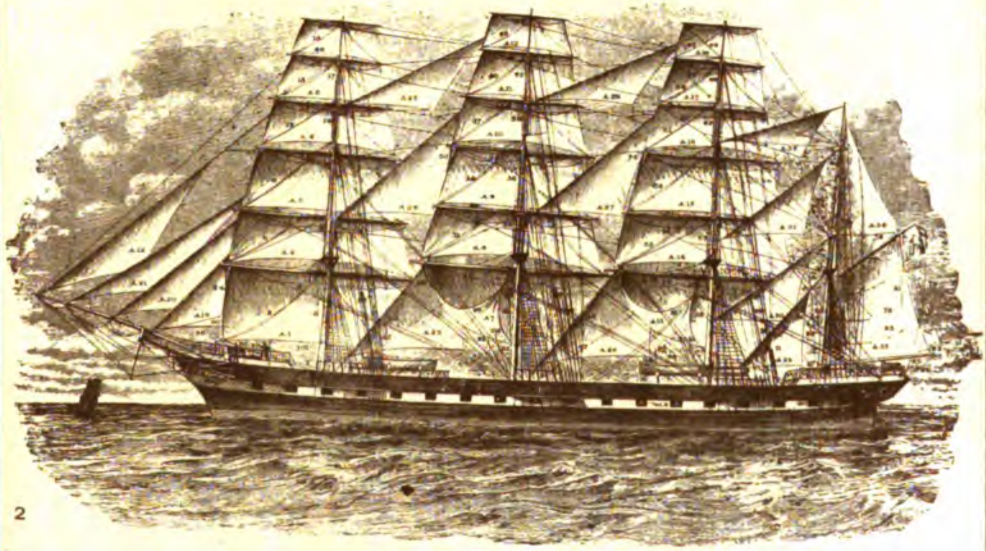
Midship section of wooden vessel: A, keel; B, keelson; C, false keel; D, floor; EE, futtocks; F, top-timber; G, lengthening piece; HH, wales; I, diminishing planks; K, bottom planks; L, garboard strakes; M, beam; N, deck; O. shelf; P, waterway; Q, spirketting; R, clamps; S, knees; T, side keelsons; V, limber strakes; W, rough-tree rail; X, mast.

small yachts and boats. The material commonly used for wooden vessels are oak, teak, cedar, pine, beech, elm, and many others, some being more suitable for one purpose, and some for another. In forming the separate pieces of the frame, which is technically called the conversion of the timber, the principal points to be studied are the use of the proper wood to give the requisite strength or toughness to each part; the selection of pieces from which the most important parts can be cut in the most perfect manner, and all the frame made as strong and free from faults as possible; and lastly, the economical use of timber. The last object is often found to be practically antagonistic to the others, for though a small gain which sacrifices the efficiency of a costly machine can never be dreamed of as economy, it is not always easy to hit the exact mean between waste of material and sacrifice of efficiency; and when a low prime cost is an object, false economy is often practised deliberately. It is one of the advantages of the use of iron that the cost of material can be more exactly proportioned to the degree of efficiency it is designed to secure.

Keel and Frame.— The keel is usually made of elm, which is tough and not easily injured by water, and is very suitable for receiving the numerous fastenings necessary to fit the other

Digitized by Google





1. The Hull, Spars and Standing Rigging.
2. The Sails, Masts and Running Rigging.

Digitized by Google

parts into it. In large vessels the keel is usually made of several pieces of timber scarfed together. The keel is not perfectly horizontal, but deeper at the stern than the bow, which gives the ship greater steadiness and freedom of motion. Below the keel is placed the false keel, of elm 4 to 5 inches thick, which protects the true keel from abrasion, and gives greater steadiness to the ship. At both ends of the keel is placed the dead-wood, which, cut into a curvilinear form at its upper surface, forms the line of the bottom of the ship's body. The stem and stern posts are set up at each extremity. The stem post is curved at its lower extremity. In a large ship it is divided into three pieces, called upper, lower, and middle. The scarf which unites the stem post with the keel is called the boxing. The stern post is, if possible, made of one piece of oak, so as to have greater strength to support the rudder. It is inserted into the keel by tenons and mortices. The frame of the ship consists of floors, cross-pieces, futtocks, and top timbers. The floor timbers are placed across the keel perpendicularly to its length, the upper surface of the keel and dead-wood being cut to receive them. They are fastened in various manners. The timbers which join the floor are called the first futtocks. Other floors and futtocks are placed upon the first to complete the frame. The timbers of the frame below the surface of the water are curvilinear, above it nearly rectilinear. The distance between the frames is called room and space. Upon this the relative weight and strength of the ship greatly depend. The stemson is worked in as a support to the stem; the keelson, placed above the keels, serves to secure the floor timbers, and is scarfed to the stemson and sternson, which latter is bolted to the stern post. The beams which support the decks are received on longitudinal ribs called shelves, which form part of the frame, and above which are the waterways. The frame being completed the skin or planking is applied, the vessel being first set upright, and plumbed to ascertain that her frame is duly proportioned. The outer planking of a large vessel of oak is 3 to 6 inches thick. It is fastened to the ribs by bolts and trenails, or by plugs of oak tightened by wedges. The decks of a ship are not completely flat, but are set to the segment of a large circle, which enables them to throw off the water. The holes for carrying away the water are called scuppers. The seams of the outer planking of a wooden vessel are made watertight by caulking. This is forcing oakum (see OAKUM), by means of sharp iron wedges called caulking irons, into the seams of the planking, which are forced open by reaming irons. The seams are then payed with melted pitch. The decks are also caulked with oakum.

Iron and Steel.— For ship-building purposes iron and steel have been found by experience to be greatly superior to wood. An iron vessel is lighter than a wooden one of the same size, and with iron the same strength may be obtained with less weight. Iron is also far more manageable than wood, as it can be bent with ease into any required shape. Steel is a still lighter material than iron. The same names for the different parts are generally retained in building with iron or steel, though they have little correspondence with the parts of a wooden vessel except in position. The keel is of far less importance than in wooden ships, and does not as in them hold the position of foundation or "backbone" to the whole structure, since an iron vessel ought to be mutually supporting throughout. An iron ship, in fact, resembles a tubular iron bridge, closed at both ends, and the deck is of as much importance as the bottom to the strength of the whole. The keel is constructed of plates riveted together, and sometimes is made hollow. From it, and riveted to it on either side, rise the ribs, which are girders built up of plates, and to the ribs on the outside is fastened the plating. The plating consists of sheets of iron plate overlapping each other at the edges, where they are riveted together. The plates vary in thickness according to position and strength required. There may be an inner skin of plating as well as an outer, and this of course adds to the strength and safety of the vessel. The ribs are tied together and at the same time held apart by beams of iron, which support the deck or decks. The decks consist of wooden planking with thin metal plates below. In the finer class of ships there are water-tight partitions or bulkheads of iron stretching across the vessel from side to side and from keel to deck, with water-tight doors in them, so that if in case of an accident the water gets into one of them the rest may keep the ship afloat.

Launching.— The launching of a vessel is a delicate operation, and, as marking the completion of the more important labors of the ship-builder, is frequently made the occasion of a public exhibition and celebration. Two parallel inclined platforms of solid timber are laid one on each side of the keel, at the distance of a few feet from it and extending from the stem as far below the stern as can be reached at low water. In this position they are carefully and firmly blocked and supported throughout their length. This double platform is called the ways. Upon it a second system of timber is loosely laid, and well greased between. The space from these last to the ship's bottom is everywhere filled with wedges of soft wood fashioned to its curves. The whole is called the cradle. The extremities of the cradle at the bow and stern are bound tightly across the keel with chains or ropes, and it is further kept from spreading by stout moldings, which overlap the outer edges of the ways. When the rising tide has reached well up the ways the wedges are simultaneously driven on every side, and the ship is raised from the blocks on which she has hitherto rested, and made to repose entirely on the cradle. The shores are all removed except the two spurs or dog-shores near the stem, and when the proper moment has arrived these are also knocked away by falling weights, the rope holding up which is cut when all is ready. The vessel, now abandoned to her weight, and encouraged by the yielding of the grease, begins slowly falling along the inclined plane; her motion becomes at each moment more and more rapid until finally the noble fabric has abandoned its union with the land, and entered upon its destined element.

Masts and Spars.— There are various rules for sparring ships, all founded upon their length and breadth, which are the main elements of stability. It may be sufficient to name one simple rule for the length of the main mast, this being the prime mover; deduct one twelfth from

Digitized by Google

the vessel's extreme breadth, multiply the result by 2; this will give height of mast from deck. The top mast may be three fifths of the lower mast, the main yard seven eighths of the same, and so on upward. The foremast may equal seven eighths of the main, with upper masts and yards in proportion. The mizzen mast, if stepped on the keelson, is five sixths of the main mast. The best rules on this subject are perhaps found in tables accurately prepared, in which the lengths of the masts are given in fractions of the ship's breadth, and those of the yards in fractions of the length. For the rest, it will be in most cases necessary to modify any given rule, in all instances, with immediate reference to the particular model of the ship, and to the uses for which she is destined. It would be an advantageous improvement in merchant ships, not sparred to the extent of their capacity, to make the fore and main masts in all cases of equal dimensions. With improved appearance they would have all the respective spars and sails, except the courses, answering equally for both masts. This would enable them to go to sea with fewer spare ones, or to derive more advantage from the usual number. In small ships all the spars are of single sticks of pine timber, which, for equal contents, are always stronger; but for ships above 600 or 700 tons it is impossible to procure single trees sufficiently large; and then it becomes necessary to resort to made masts (so called), which are of oak and pine, very artificially put together, and bound with stout hoops of iron. Hollow iron masts are also frequently used.

Rigging.— Many large vessels are fitted with four masts, some with five. The standing and part of the running rigging are formed of wire rope. The masts and bowsprit of a ship are not abandoned to their own unsupported strength, but require to be sustained by the standing rigging. This consists, for the bowsprit, of gammoning and bob-stays, confining it down to the stem; and shrouds, which sustain the immense lateral pressure which it endures when on a wind. The jib-boom and flying jib-boom are in like manner supported by means of martingales and guys. The foremast is supported by three or four pairs of shrouds on either side, and by two stays led forward to the bowsprit. The foretop mast is supported by shrouds setting up in the top, back-stays descending to the channels (broad pieces of planks fixed edgewise to the outside of the vessel for spreading the lower rigging), and stays leading to the bowsprit end. The topgallant and royal masts have also their shrouds setting up through the cross-trees, their backstays descending to the channels, and their stays leading to the jib and flying jib-booms. In like manner are the main and mizzen masts supported, except that the main-stays set up on deck beside the heel of the bowsprit, the main-top-mast-stays at the head of the foremast, the main-top-gallant-stay to the fore-top-mast-head, and main-royal-stay to the fore-top-gallant-mast-head. The mizzen-stay also sets up beside the mainmast, and the same in ascending. The running rigging consists of the tacks and sheets that serve to spread the sails, the halyards, traces, lifts, clewlines, and all other ropes used in making, taking in, or maneuvering the sails.

Sails.— The sails of a ship are square sails bent to the yards, and fore-and-aft sails traversing on stays or bent to gaffs. Let us describe an entire suit, beginning forward. On the extremity of the bowsprit is the flying jib, a three-cornered sail, which goes from the end of its boom upward along its stay, leading to the fore-top-gallant-mast-head, and confined to the stay by rings of wood or iron, called hanks. The jib, which leads from its boom to the fore-top-mast-head, is of similar form, and so is the fore-top-mast-stay-sail, running from the bowsprit end toward the masthead. On the foremast we have the foresail, bent to the foreyard, and spread at the foot by means of tacks and sheets; above it, the fore-top-sail, bent to the top-sail-yard, by means of which it is hoisted aloft, while its lower corners are spread to the extremities of the foreyard; next the top-gallant-sail, bent to its yard, and sheeting home to the top-sail-yard; and so with the royal and sky sail. Double top-sails and top-gallant-sails are now much in use, that is to say, these sails are practically made each into two sails, which gives greater ease in handling. All these sails are turned at pleasure, to be presented to the wind, by means of braces attached to their yard-arm, and leading to the mainmast. The mainmast is furnished with a similar suit of sails, somewhat larger; the mizzen, also, though smaller than either, instead of a square sail on the lower mast, it has a gaff sail, hoisting up and down abaft the mast. Some ships have similar gaff sails on the fore and main masts, which are found of great use in gales of wind as a substitute for storm staysails. Most carry also light staysails between the masts; but they are very troublesome, and worse than useless. Studding sails extended on special spars outside the square sails when going large are very useful. The perfection of equipping a ship with spars, rigging, and sails, consists in so disposing them, that, in a whole-sail breeze, the centre of effort of all the sails will be in the same line with the ship's centre of rotation; or that the efforts of the forward and after sails to turn the ship will be so exactly balanced as not to require any continued assistance from the rudder in either direction; for this, while it impedes her progress, does not leave the entire force of the rudder disposable when necessary to turn. Of the two evils, however, seamen have more patience with a ship disposed to approach the wind than with one needing the continued action of the helm to keep her from falling off.

The accompanying plates show the hull, spars, rigging, sails, etc., of a four-masted vessel, having the aftmost or jigger-mast bark-rigged (four-masted bark). All the names of the various parts will be found from the following lists:

PLATE I.

THE HULL, SPARS, AND STANDING RIGGING.

The Hull.

1. Head
2. Cutwater.
3. Bow.
4. Forecastle-deck.
5. Stern.
6. Rudder.
7. Fore-chains.
8. Main-chains.
9. Mizzen-chains.
10. Bulwarks.
11. Poop-deck.
12. Ports.
13. Trail-boards.
14. Cat-head.
15. Head-rails.
16. Capstan.
17. Skylight.
18. Light-boards.
19. Foredeck-house.
20. Life-boats.
21. Gig.
22. Companion.
23. Skylight.
24. Wheel-box.
25. Poop-rails.
26. Afterdeck-house.

Digitized by Google

The Spars.

27. Bowsprit.
28. Inner jib-boom.
29. Outer jib-boom.
30. Flying jib-boom.
31. Martingale.
32. Fore-mast.
33. Fore-topmast.
34. Fore-topgallant mast.
35. Fore-royal mast.
36. Main-mast.
37. Main-topmast.
38. Main-topgallant mast.
39. Main-royal mast.
40. Mizzen-mast.
41. Mizzen-topmast.
42. Mizzen-topgallant mast.
43. Mizzen-royal mast.
44. Jigger-mast.
45. Jigger-topmast.
46. Jigger-topgallant mast.
47. Fore-yard.
48. Fore lower topsail yard.
49. Fore upper topsail yard.
50. Fore lower topgallant yard.
51. Fore upper topgallant yard.
52. Fore-royal yard.
53. Main-yard.
54. Main lower topsail yard.
55. Main upper topsail yard.
56. Main lower topgallant yard.
57. Main upper topgallant yard.
58. Main-royal yard.
59. Crossjack yard.
60. Mizzen lower topsail yard.
61. Mizzen upper topsail yard.
62. Mizzen lower topgallant yard.
63. Mizzen upper topgallant yard.
64. Mizzen-royal yard.
65. Jigger-gaff.
66. Jigger-boom.
67. Fore-top.
68. Main-top.
69. Mizzen-top.
70. Jigger-top.
71. Fore-doublings.
72. Fore-mast cap.
73. Fore-topmast cross-trees.
74. Fore-topmast cap.
75. Ensign.
76. Company's flag.

The Standing Rigging.

A 1. Bobstay.
A 2. Bowsprit-shroud.
A 3. Martingale-stay.
A 4. Jib-boom guys.
A 5. Fore-stays.
A 6. Fore-topmast stays.
A 7. Inner-jib stay.
A 8. Outer-jib stay.
A 9. Flying-jib stay.
A 10. Fore-royal stay.
A 11. Fore-rigging.
A 12. Fore-topmast rigging.
A 13. Fore-topgallant rigging.
A 14. Fore-cap back-stay.
A 15. Fore-topmast back-stays.
A 16. Fore-topgallant back-stays.
A 17. Fore-royal back-stay.
A 18. Fore-lift.
A 19. Fore-topsail lift.
A 20. Fore-topgallant lift.
A 21. Fore-royal lift.
A 22. Main-stays.
A 23. Main-topmast stays.
A 24. Main-topgallant stays.
A 25. Main-royal stays.
A 26. Main-rigging.
A 27. Main-topmast rigging.
A 28. Main-topgallant rigging.
A 29. Main-cap back-stay.
A 30. Main-topmast back-stays.
A 31. Main-topgallant back-stays.
A 32. Main-royal back-stays.
A 33. Main-lift.
A 34. Main-topsail lift.
A 35. Main-topgallant lift.
A 36. Main-royal lift.
A 37. Mizzen-stays.
A 38. Mizzen-topmast stays.
A 39. Mizzen-topgallant stay.
A 40. Mizzen-royal stay.
A 41. Mizzen-rigging.
A 42. Mizzen-topmast rigging.
A 43. Mizzen-topgallant rigging.
A 44. Mizzen-cap back-stay.
A 45. Mizzen-topmast back-stays.
A 46. Mizzen-topgallant back-stays.
A 47. Mizzen-royal back-stays.
A 48. Crossjack lift.
A 49. Mizzen-topsail lift.
A 50 Mizzen-topgallant lift.
A 51. Mizzen-royal lift.
A 52. Jigger-stays.
A 53. Jigger-middle stay.
A 54. Jigger-topmast stay.
A 55. Jigger-topgallant stay.
A 56. Jigger-rigging.
A 57. Jigger-topmast rigging.
A 58. Jigger-topmast back-stays.
A 59. Jigger-topgallant back-stays.

PLATE II.

THE SAILS AND RUNNING RIGGING.

The Sails.

A 1. Fore-sail.
A 2. Fore lower topsail.
A 3. Fore upper topsail.
A 4. Fore lower topgallant sail.
A 5. Fore upper topgallant sail.
A 6. Fore-royal.
A 7. Main-sail.
A 8. Main lower topsail.
A 9. Main upper topsail.
A 10. Main lower topgallant sail.
A 11. Main upper topgallant sail.
A 12. Main-royal.
A 13. Crossjack.
A 14. Mizzen lower topsail.
A 15. Mizzen upper topsail.
A 16. Mizzen lower topgallant sail.
A 17. Mizzen upper topgallant sail.
A 18. Mizzen-royal.
A 19. Fore-topmast stay-sail.
A 20. Inner-jib.
A 21. Outer-jib.
A 22. Flying-jib.
A 23. Main-topmast stay-sail.
A 24. Main-topgallant stay-sail.
A 25. Main-royal stay-sail.
A 26. Mizzen-topmast stay-sail.
A 27. Mizzen-topgallant stay-sail.
A 28. Mizzen-royal stay-sail.
A 29. Jigger stay-sail.
A 30. Jigger middle stay-sail.
A 31. Jigger-topmast stay-sail.
A 32. Jigger-topgallant stay-sail.
A 33. Jigger.
A 34. Gaff topsail.

The Running Rigging.

1. Fore-tack.
2. Fore-sheet.
3. Fore clew-garnet.
4. Fore-braces.
5. Fore lower topsail sheet.
6. Fore lower topsail clew-lines.
7. Fore lower topsail braces.
8. Fore upper topsail sheets.
9. Fore upper topsail clew-lines.
10. Fore upper topsail braces.
11. Fore lower topgallant sheet.
12. Fore lower topgallant clew-lines.
13. Fore lower topgallant braces.
14. Fore upper topgallant sheet.
15. Fore upper topgallant clew-lines.
16. Fore upper topgallant braces.
17. Fore-royal sheet.
18. Fore-royal clew-lines.
19. Fore-royal braces.
20. Fore-topsail halyards.
21. Fore-topgallant halyards.
22. Fore-royal halyards.
23. Fore-signal halyards.
24. Fore reef-tackles.
25. Fore topsail reef tackles.
26. Main-tack.
27. Main-sheet.
28. Main clew-garnet.
29. Main-brace.
30. Main lower topsail sheet.
31. Main lower topsail clew-lines.
32. Main lower topsail brace.
33. Main upper topsail sheet.
34. Main upper topsail clew-lines.
35. Main upper topsail braces.
36. Main lower topgallant sheet.
37. Main lower topgallant clew-lines.
38. Main lower topgallant braces.
39. Main upper topgallant sheet.
40. Main upper topgallant clew-lines.
41. Main upper topgallant brace.
42. Main-royal sheet.
43. Main-royal clew-lines.
44. Main-royal braces.
45. Main-topsail halyards.
46. Main-topgallant halyards.
47. Main-royal halyards.
48. Main signal-halyards.
49. Main reef-tackles.
50. Main-topsail reef tackles.
51. Crossjack tack.
52. Crossjack sheet.
53. Crossjack clew-garnet.
54. Crossjack braces.
55. Mizzen lower topsail clew-lines.
56. Mizzen lower topsail braces.
57. Mizzen upper topsail sheet.
58. Mizzen upper topsail clew-lines.
59. Mizzen upper topsail braces.
60. Mizzen lower topgallant sheet.
61. Mizzen lower topgallant clew-lines.
62. Mizzen lower topgallant braces.
63. Mizzen upper topgallant sheet.
64. Mizzen upper topgallant clew-lines.
65. Mizzen upper topgallant braces.
66. Mizzen-royal sheet.
67. Mizzen-royal clew-lines.
68. Mizzen-royal braces.
69. Mizzen-topsail halyards.
70. Mizzen-topgallant halyards.
71. Mizzen-royal halyards.
72. Mizzen-signal halyards.
73. Crossjack reef-tackles.
74. Mizzen-topsail reef-tackles.
75. Jigger peak-halyards.
76. Jigger brails.
77. Jigger gaff-topsail sheet.
78. Ensign halyards.
79. British ensign.
80. Gaff-topsail halyards.
81. Vangs or Vanes.
82. Jigger outhaul.
83. Boom topping lift.
84. Boom guys.
85. Boom sheet.
86. Flying-jib sheet.
87. Outer-jib sheet.
88. Inner-jib sheet.
89. Fore-topmast stay-sail sheet.
90. Fore-bowline.
91. Main-topmast stay-sail sheet.
92. Main topgallant stay-sail sheet.
93. Main-royal stay-sail sheet.
94. Mizzen-topmast stay-sail sheet.
95. Mizzen-topgallant stay-sail sheet.
96. Mizzen-royal stay-sail sheet.
97. Jigger stay-sail sheet.
98. Jigger-topmast stay-sail sheet.
99. Jigger-topgallant stay-sail sheet.
100. Reef points.
101. Fore-buntlines.
102. Main-buntlines.
103. Crossjack buntlines.

Cargo and Ballast.— When the articles in a ship's cargo are heavy and light, the heavier are placed nearest the bottom, to increase the ship's stability. When, however, all are heavy, there may be danger of making a ship too stiff; so that, not being balanced, she will roll violently, and, perchance, risk the fracture of a mast, or even spring a leak. To obviate this danger the cargo should be raised; if iron, some should be stowed between decks; if coal or salt, it may be

Digitized by Google

heaped up in the centre, taking care to secure it against shifting, should the ship be knocked down by a sea or squall. Heavy articles should never be placed toward the extremities, lest they promote pitching. In all cases care must be taken to preserve the trim of the ship — that just proportion between her draft forward and aft which the estimate of the builder, or, when a voyage has been made, experience itself, has determined to be most favorable to rapid sailing. See also NAVIGATION; SHIP-BUILDING.

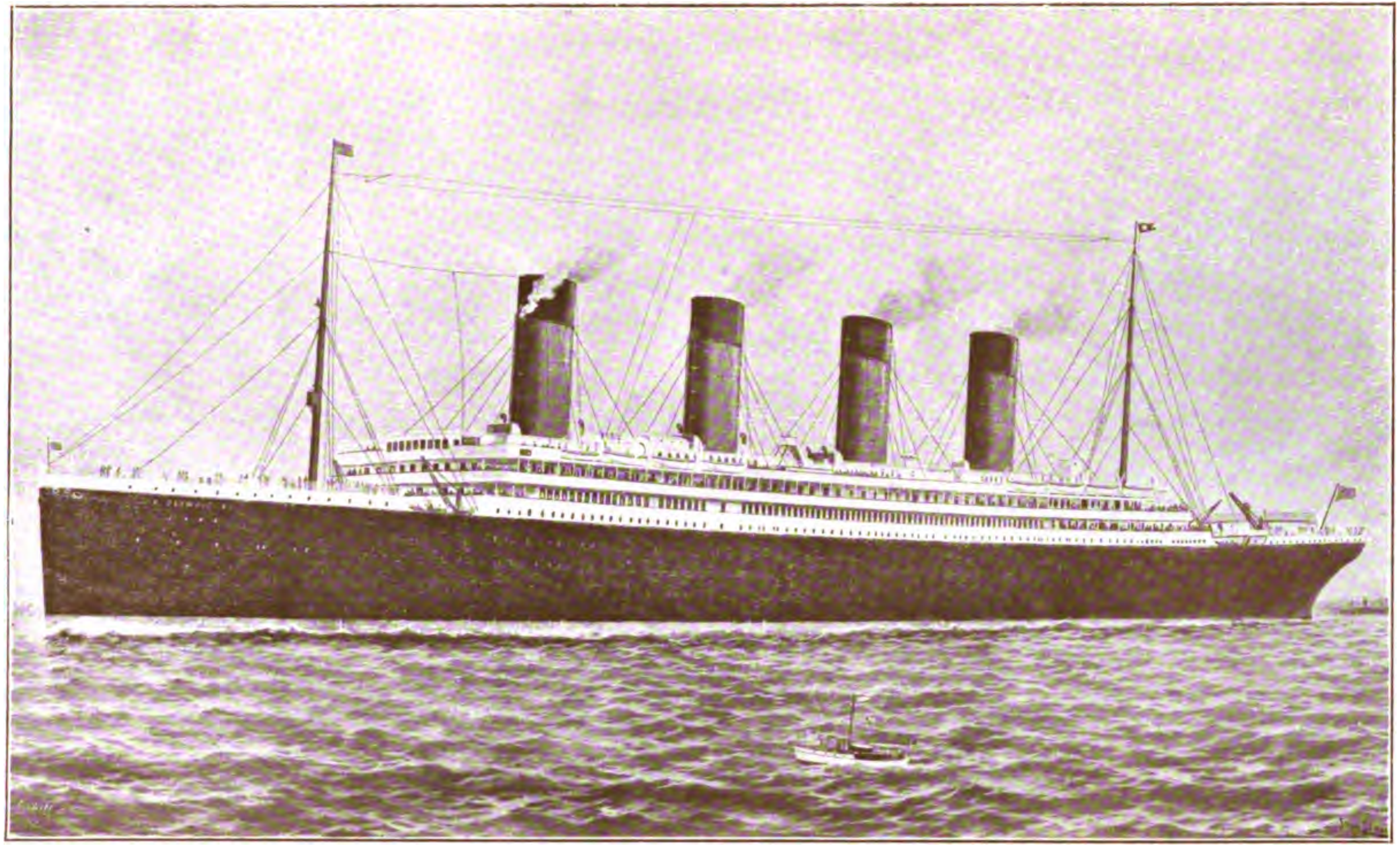
Ship-building. The early history of ship-building and the development of the sailing ship and the steam ship will be found under the titles SAILING VESSELS; SHIP, and STEAM VESSELS. The change from wood to iron in ship construction about the middle of the 19th century, was followed by the revolutionary methods of steel ship-building, and by 1890 steel had displaced iron in the shipyards of Great Britain and the United States. American ship-building under the era of steel reached its perfection in 1892 and 1896, when the Saint Louis and the Saint Paul, two ocean liners, were built by the Cramp Company. These vessels were constructed entirely of domestic material, thus marking a new era in American ship-building. American yards now receive orders not only from foreign firms for merchant ships, but from foreign governments for warships. Within a very few years the system of utilizing power has been revolutionized in shipyards. Electric power is largely used at the Cramp yards and almost exclusively at the New York Ship-building Company's plant in Camden, N. J.

American Tonnage.— During the fiscal year ended 30 June 1910, the Bureau of Navigation reported that 1,361 vessels of 342,068 gross tons were built in the United States and officially numbered, compared with 1,241 vessels of 238,090 tons for the previous fiscal year. The increase compared with 1901 was in vessels of 1,000 gross tons and upward. For 1910 new sail tonnage was 19,358 tons; 1909, 28,950 tons. For 1910 new canal boats, barges, etc., aggregated 64,717 tons; 1909, 60,932 tons. New steel steamers aggregated 234,988 tons, compared with 123,142 tons in 1909. In 1910 the total output of the world's shipyards amounted to 589 vessels, aggregating 1,551,532 tons. Of these the output of Great Britain and her colonies amounted to 465 ships, aggregating 991,113 tons, distributed as follows: Scotland, 362 ships of 204,451 tons; England, 380 ships of 663,377 tons; Ireland, 17 ships of 118,295 tons; the royal dockyards, 6 ships of 45,990 tons; the colonies, 70 ships of 60,027 tons. The total tonnage built in the United States — which ranked second — was 342,068, or a little more than the year before. On our seaboard there are 12 shipyards capable of turning out vessels of the largest class, and 17 others at which average-sized ships can be built. On the Lakes there are nine large ship-building establishments and five smaller ones.

Steel Schooners.— The use of steel in the construction of the modern passenger steamships (see STEAM VESSELS) and of the modern naval vessel (see WARSHIPS) has developed the steel freighter, the merchant schooner with four, five, six, and seven masts. Indeed the development of the multi-masted merchant schooner, which has advanced with such rapid strides during the past few years, is one of the most remarkable features in the ship-building industry of the Atlantic coast. The fore-and-aft schooner has always been a favorite type of ship in the American merchant trade, whether coasting or deep-sea, and the great breadth of hull and length of spars of such craft have rendered them an easily recognized type the world over. As compared with the square-rigged vessels of the schooner, brig, brigantine, or bark type, the American fore-and-after has the advantage of being a better craft when sailing close-hauled and of requiring fewer men to man it. In an earlier day of the development of our merchant marine in the coasting trade, the two-masted schooner was the common type; then came the three-masted schooner, and this was followed by vessels of four, five, six, and now seven masts. The carrying capacity of these schooners, the largest of which are engaged almost entirely in the coal-carrying trade, is exceedingly large. Thus, the five-masted schooner constructed at Camden, Maine, in 1899, is 318 feet in length, 44 feet beam, and 21½ feet in depth. The vessel will carry 4,000 tons of coal on her maximum draft. Work on this vessel had scarcely been completed before Capt. Crowley, of Taunton, Mass., had given orders for the construction of a six-masted schooner. This vessel is 330 feet in length, 48 feet in beam, and has 22 feet depth of hold. On her maximum draft of 24 feet she will carry 5,500 tons of cargo. Her lower masts are each 116 feet in length, and her topmasts 58 feet.

Then came the seven-masted steel schooner in 1903, built from designs by B. B. Crowninshield, of Boston, the designer of many small and very successful racing craft. Unlike her predecessors, the new schooner is constructed throughout of steel. She has a bar keel of forged steel 3½ inches in width by 12 inches in depth, which extends from stem to sternpost. There is a cellular double bottom with a continuous, single, vertical, keel plate weighing 22.5 pounds to the square foot. The upper bilge-strake is of 28¾-pound plate for two thirds of the length. The middle bilge-strake is of 30 pounds weight for the same distance and the lower bilge-strake 25 pounds. The bottom strake is of 20-pound plate, while the garboard strake is of 29-pound plate for two thirds of the length. All of the plating reduces to 18¾ pounds at the ends of the vessel, except in the case of the garboard strake, which will reduce to 25 pounds at the ends. There are three complete decks, which are of steel plating, the upper deck, forecastle and poop-deck being wood-covered. A collision bulkhead is worked in at a suitable distance from the stem. The lower masts throughout the vessel are built of steel, with lapped edges, flush butts, and stiffening angles extending inside for the full length. The plates are single-riveted at the edges and double-riveted at the butts. The plating is double at the mast partners and at the hounds. The masts are all 135 feet in length from the mast step to the top of the upper band, and they have a uniform diameter throughout of 32 inches. The topmasts are of Oregon pine. They are 58 feet in length over all, tapering from 18 inches in diameter to 10 inches, except the foremast,

Digitized by Google



WHITE STAR STEAMSHIP "OLYMPIC".

Tonnage, registered 45,000; tonnage, displacement 66,000; length over all 882 feet, 6 inches; breadth over all 92 feet, 6 inches; breadth over boat deck 94 feet; height from bottom of keel to top of Captain's house 105 feet, 7 inches; height of funnels above casing 72 feet; height of funnels above boat deck 81 feet, 6 inches; distance from top of funnel to keel 175 feet; number of steel decks 11; number of watertight bulkheads 15; passengers carried 2,500; crew 860.

Digitized by Google

Digitized by Google

which is 64 feet in length and 20 inches at its point of greatest diameter. The booms of the first five masts are 45 feet in length by 14 inches in diameter, the spanker boom being 75 feet in length by 18 inches in diameter. The total sail area of the lower sails and topsails is 40,617 square feet. All of the standing rigging, and in special cases the running rigging for the lower sails, are of a high quality of wire rope. Although this vessel is propelled entirely by sails, she carries quite a considerable instalment of machinery, including one 9-inch by 10-inch Hyde double-cylinder ship engine, and five 6-inch by 8-inch Hyde hoisting engines. There are two vertical boilers 56 inches in diameter by 90 inches high, one in the forward house and one in the after house. The boilers are built for a working pressure of 100 pounds to the square inch. There are two 8-inch by 4-inch by 6-inch duplex pumps and two direct-acting steam pumps, with steam and water cylinder, each 12 inches in diameter by 12 inches stroke. As the result of the installation of steam power on board for the purpose of hoisting anchors and sails the number of hands necessary to work this large vessel is considerably reduced, the total number required being only 19 men. The total cost of the vessel delivered was about $250,000.

Steel Steamships.— As a type of the modern ocean liner built of steel, the Minnesota constructed at New London, Conn., in 1903, is illustrative of the wonders of latter day ship-building. The dimensions of the Minnesota are: Length over all, 630 feet; breadth, 73 feet 6 inches; molded depth from keel to upper deck, 56 feet. On a draft of 33 feet the displacement is 33,000 tons, and on a maximum draft of 36½ feet, to which the vessel can be loaded whenever the depth of our harbors will admit of it, the displacement will be 37,000 tons. The space occupied by machinery is the smallest practicable, so that space for cargo may be as large as possible. In order that cargo may be readily stowed, the ordinary type of hold pillar has been dispensed with, and large box-shaped columns are fitted, supporting heavy girders which run longitudinally under the transverse beams which carry the decks. These columns are widely spaced, and in some cases only one is fitted in a hold, whereas by the older method ten pillars would be required. A longitudinal bulkhead is fitted the whole length of the ship; this divides each hold into two separate compartments, and therefore the hatches are fitted in pairs, one to each hold. Some of the hatches are so large that bulky freight, such as a locomotive or freight car, or large marine or land boilers, can be lowered right down into the hold. Every hatch can be loaded or discharged simultaneously if desired. The cargo-handling plant on this vessel is very complete, and designed so as to cut down the number of men to a minimum. Two winches and two booms are fitted to handle cargo at each hatch. The booms, 34 in number, are built of steel. Two heavy booms are fitted to lift weights of from 30 to 50 tons. The winches for cargo handling are 34 in number, all electrically operated. One hold in the ship is devoted to carrying frozen meat, and is completely insulated; its capacity being about 2,500 tons. The insulation is so arranged that ordinary cargo can be carried on return trip. The arrangement of coal bunkers is a novel feature on this ship. The bunkers are located above the boilers; the ends of the bunkers are inclined in such a manner that the bulk of the coal will gravitate through chutes and be deposited on the firing platform. The capacity of the permanent bunker is over 4,000 tons, and a reserve bunker is fitted contiguous to the boiler room, having a capacity for about 2,000 tons of coal. The Minnesota has 16 Niclausse water-tube boilers, having a working pressure of 260 pounds per square inch. They will supply steam to two main engines of the triple-expansion type, which are arranged side by side, working separate shafts. The propeller wheels are 20 feet in diameter, and revolve 78 times per minute. The horse-power of the engines is about 10,000, and they will drive the ship at a speed of about 14 knots per hour. To realize the great size of the ship, one must but recapitulate the various decks, platforms, etc., from the keel to the topmost bridge. First there is the outer bottom of the ship; 6 feet above that is the inner bottom or floor; then within the molded or plated structure of the vessel are the orlop, lower, between, main, and upper decks. All of these decks are of steel plating, and the whole structure of the ship from the bottom to the upper deck is 56 feet in height, the upper deck running, as we have said, in an unbroken sweep the whole 630 feet length of the vessel. Above the upper deck are the promenade deck, the upper promenade deck, and the boat deck, this last being about 80 feet above the keel, while 8 feet above this, or 88 feet above the keel, is the captain's bridge. Now, since the vessel at her lightest draft draws 17 feet of water, the captain's bridge, when the vessel is running light, will be over 70 feet above the water, and the passengers on the topmost upper deck will be between 60 and 70 feet above the water.

American Seamen.— In considering the important question of the manning of American ships, it is gratifying to learn that there is a marked increase in the percentage of American over seamen of foreign nationality. The returns compiled from the reports of shipping commissioners showing the nationality of seamen shipped on American vessels for the 17 years from 1893 to 1910, prove that there has been an increase in the percentage of Americans from 31 per cent in 1905 to 49.2 per cent in 1909, and to 49.3 per cent in 1910. Out of a total of over 71,000 shipped in 1894, 22,000 were Americans, 22,000 Scandinavian, 10,000 British, 6,000 Germans, 865 Italians, and 628 were French; while various other nationalities together represented a total of 9,000. In 1910, out of a total of over 185,700 shipped, 91,546 were Americans, 18,600 Scandinavians, 21,006 British, 6,800 Germans, 3,649 Italians, 24,546 Spanish, and there were about 38,500 of mixed nationality. It must be understood that while there is a total of about 190,000 shipments, they really represent only about 40,000 seamen. Further proof of the greater interest of Americans in their merchant marine and their tendency to seek employment therein is afforded by a table given by the Commissioner of navigation, showing the nativity of men employed on 654 sea-going American vessels. Out of a total of 13,879 men, 5,455 are Americans by birth or naturalization, 2,347 are British, and the balance is made up of various nationalities. As the table does not include the masters of

Digitized by Google

these vessels, all of whom must be citizens, it may be said that of the whole complement of these vessels, amounting to 14,536, 42 per cent were Americans. See, also, AMERICAN SHIP-BUILDING; NAVAL ARCHITECTURE; SHIP.

Ship-building, American. See AMERICAN SHIP-BUILDING.

Ship-canals. See CANALS; WATERWAYS.

Ship-fever. See TYPHUS FEVER.

Ship-money, a tax which had much to do with provoking the rebellion which cost Charles I. his head. It was customary in England in times of extraordinary peril for the sovereign to call upon the seaports and maritime counties to supply ships-of-war for the national defense. The ships which took part in the defeat of the Spanish Armada were obtained in this way. No such peril existed when Charles I., in October 1634, ordered the magistrates of London and other seaport towns to provide ships-of-war, and also empowered the magistrates to levy a tax for that purpose. Resistance to the levy was met by further decrees, extending the tax to the whole kingdom, and directing that every landholder and other inhabitant be assessed according to his means, and the tax collected by distress if necessary. When John Hampden refused to pay the tax, and was brought to trial, the judges decided, eight to four, in favor of the Crown. One of the early acts of the Long Parliament in 1640 was to declare the ship-money tax illegal, and no attempt has since been made to collect ship-money in England.

Ship-railway, a railroad for transporting vessels from one body of water to another. Capt. J. B. Eads' plan for the Tehuantepec Ship Railway across the isthmus between North and South America, in Mexican territory, consists essentially of a series of some eight or ten tracks, having a carrying car or cradle of some five sections, with altogether 1,000 wheels. Calculated for a vessel of 10,000 tons, this would not give a pressure so great as that of an ordinary locomotive. A ship-railway is in operation by the Canadian government between Chignecto Bay, in the Bay of Fundy, across the isthmus to Northumberland Straits, a distance of 17 miles. This enables vessels to go from Prince Edward Island to Saint John, New Brunswick, in 12 hours, and greatly facilitates the transport of grain in bulk from the lake ports to New Brunswick. The vessels are raised by hydraulic pressure a height of 40 feet to the level of the railway, and placed on a double track 18 feet from centre to centre. The flexible car system of ship-railway invented by William Smith, harbor engineer of Aberdeen, Scotland, is designed to allow of the use of ordinary railway gradients. The car is in sections, each carried on a compound bogie running on parallel lines. Vertical and lateral flexibility are secured, and the ship is sustained on the car by water-cushions, so that it is virtually kept floating. The ship is raised onto the cars by means of a submerged shipway enclosed within a wet dock.

Ship-sailing. See NAVIGATION, THE SCIENCE OF MODERN.

Ship Subsidies. To insure the establishment of fast American mail and passenger lines to Brazil, Argentina and the Philippines, China, Japan and Australia a bill is now being considered by Congress. It authorizes the Postmaster-General to pay the proposed lines for carrying American mail. The last section of the measure provides: "That the total expenditure for foreign mail service in any one year shall not exceed the estimated revenue therefrom for that year." It is expected that the bill, if enacted, would open up South America and the Orient to American commerce to an extent never before known in the history of the United States. It would assure a fortnightly mail and passenger service between this country and Rio Janeiro, another to Buenos Ayres a third to the West Coast of South America, two from the Pacific Coast to the Orient, and one to Australia. Ships of at least 16 knots speed would be used.

The granting of ship subsidies would not be an unusual departure of the past of the United States government. The first act authorizing postal subventions was that of 3 March 1845. Power was given to the Postmaster-General to make contracts for payments of specified rates on weight of mail carried to foreign ports—24 cents per half ounce for ports 3,000 miles distant; 10 cents per half ounce to Mexico and the West Indies. In 1847 a contract was made with the Ocean Steam Navigation Company for a mail service between New York and Bremen and Havre. The company was to receive $100,000 for six return voyages to Bremen per year, and $75,000 for six voyages to Havre. In 1850, the Collins Line, plying to Liverpool, agreed to accept $19,250 per voyage, making 20 voyages a year. A number of similar contracts were made about the same time, but in 1858 the granting of mail subventions was abandoned, and vessels carrying the mails were allowed only the sea postage plus the inland postage on mails carried. Postal subventions were allowed to lines running between New York and Rio de Janeiro, and between the Pacific coast and China, but were discontinued in 1875 after running 10 years. In 1891 a law was enacted authorizing the Postmaster-General to make contracts with American shipowners for carrying the mails between America and foreign ports. Steamships were placed in four classes: iron and steel vessels of not less than 8,000 tons with a speed of 20 knots per hour; iron and steel vessels of not less than 5,000 tons, with a speed of 16 knots; iron and steel ships of not less than 2,500 tons and a speed of 14 knots; iron, steel, and wooden ships of not less than 1,500 tons and a speed of 12 knots. This law is still in force. The most that may be paid for carrying the mails is $4, $2, $1, and 60c per mile sailed for the respective classes. The requirement is that contracts be let to the lowest bidder.

In spite of the persistent agitation of the shipping interests a general objection to all ship subsidies has prevailed in this country. It has been pointed out that American shipping on the high seas is constantly declining. In 1905 the total tonnage of the United States engaged in foreign trade was only 943,750 as contrasted with 2,496,894 tons in 1861, while the tonnage of foreign nations has constantly increased. Without government subsidies it has been contended that the costs of construction and operation are heavier in America than elsewhere. Since 1840 the United Kingdom has

Digitized by Google

granted liberal subventions for carrying the mails, while in America no action has been taken, though bills for granting subsidies have for the last 10 years been constantly before Congress. Government aid is granted to a small proportion of German shipping. In France, subsidies are paid in the form of both construction and navigation bounties. In spite, however, of the liberal payments in aid of French shipping, the industry is far from prosperous. The French mercantile marine has a tonnage of about 1,250,000 of which 650,000 consists of sailing vessels, a large part of which would not be operated at all were it not to obtain the subsidies. Germany, on the other hand, has a merchant shipping tonnage of 2,400,000 though it pays no general subsidies. The Italian government, also, has paid both operation and construction subsidies since 1886. A similar policy was adopted by Japan in 1896, and by Austria-Hungary in 1893. Other countries, however, which have granted subsidies, show an increase in tonnage fully equal to that in the case of these three latter nations.

It seems probable now that the movement in favor of the granting of subsidies to United States shipping will succeed in its purpose. The immediate cause of the administration's decison to act has been the threat of the foreign steamship lines to raise their freight rates between this country and other parts of the world. The need for a better freight and passenger service between the United States and South America is so apparent that action cannot long be delayed. At his inauguration, Marshal da Forseca, the new President of Brazil, said: "There is much to be done to foster and develop trade between the United States and Brazil. One crying necessity is an adequate cargo-boat and passenger-ship service. It is high time some American company took this matter in hand and gave us fast, up-to-date transport facilities, lack of which at present hinders the growth of trade. Establishment of such lines would give immense impetus to commercial relations between Brazil and the United States." This, it is now agreed, applies likewise to other South American countries.

Senator Frye introduced in Dec. 1910 a short measure in Congress giving American ships the advantage in the use of the Panama Canal. The bill provided that the toll charges of all ships of the United States and all merchant ships of American registry in the canal should be paid out of the United States Treasury. This is a form of subsidy for the benefit of American ships only.

Short Ballot. See BALLOT, SHORT.

Ship'ka Pass, Balkan Peninsula, extends between Bulgaria and Eastern Rumelia, at a height of 4,600 feet above sea-level, and is 87 miles distant from Rustchuk. In the hot fight between the Russians and Turks, 1877, the Russians held the position and Suleiman Pasha lost 20,000 men in his attempt to take Fort Nicholas, on the summit of the pass.

Shipley, shĭp'lĭ, **Orby,** English editor and author: b. 1 July 1832. He was graduated from Jesus College, Cambridge, in 1854; was ordained to the ministry of the Church of England; but in 1878 was received by Cardinal Manning into the Roman Catholic Church. Previous to his submission he published several works, including 'Four Cardinal Virtues' (1871); 'Theory About Sin' (1872); and 'Principles of the Faith' (1878); edited three volumes of religious poetry ('Lyra Eucharistica,' 'Messianica,' and 'Mystica' (1863-5); and wrote numerous pamphlets and articles for the periodical press. As a Roman Catholic he has published 'Truthfulness and Ritualism' (1879-80); 'Annus Sanctus' (1884); and 'Carmina Mariana,' an anthology (1893; 1902), and a generous contributor to magazines.

Shipley, England, a town of Yorkshire (West Riding), lies three miles north of Bradford, on the Aire River. The large parish church of Saint Paul is a fine modern Gothic specimen. The principal industry is the manufacture of woolens and cloths, and the quarrying of stone.

Ship'man, Louis Evan, American author and playwright: b. Brooklyn, N. Y., 2 Aug. 1869. He was educated at the Brooklyn Polytechnic Institute and at Harvard University; was editorial writer on 'Leslie's Weekly' 1895-6, and a contributor to New York 'Life' from the latter year. He has published 'Urban Dialogues'; 'D'Arcy of the Guards.'

Shippen, Edward, medical director of the United States Navy; b. in New Jersey, 18 June, 1826. He was graduated from Princeton in 1845, and received the degree of M. D. from the University of Pennsylvania in 1848. He was appointed to he United States Navy from Pennsylvania, in 1849, as assistant surgeon; promoted to commanding surgeon in 1861, and to the office of medical director in 1876; retired in 1888; rear-admiral retired, 1907. He was on the *Congress* when it was destroyed by the *Merrimac* and on the *New Ironsides* in both battles of Fort Fisher. He has written: 'Thirty Years at Sea' 'A Christmas at Sea'; 'Naval Battles of America' (1905); 'Naval Battles of the World' (1905).

Shippigan, shĭp-ĭ-găn', **Canada,** a seaport town of Gloucester County, New Brunswick, at the southeastern entrance to Chaleur Bay, opposite Shippigan Island, 70 miles east of Bathurst. It is a terminus of the Intercolonial Railway system, and has steam-ferry communication with Saint George's Bay, Newfoundland. It has a fine harbor, a maritime trade, and valuable fisheries. Beyond Shippigan Island, Miscou Island is frequented by sportsmen for plover, the best in Canada.

Shipping Articles. See SEAMAN.

Shipping, Law of. A ship is a vessel intended for navigation and transportation, and from a legal standpoint a floating elevator; a floating bath-house and a steam-dredge are ships. The question of ownership is most important, and the rulings thereon are not uniform in the United States and England. In the United States the rule has always been that a contract to purchase a vessel from a ship-builder, and to pay in instalments as the work progresses, does not pass the title to the purchaser until the vessel is in a deliverable state, and the purchaser is notified to that effect, unless the parties stipulate that title shall pass sooner. The British House of Lords has finally established on appeal that this is the rule also in England. Title to a ship can pass by oral contract in the United States; in England a

Digitized by Google

bill of sale is necessary. In case of disagreement between the owners of a vessel as to the use to which it shall be put, or whether it shall be used at all, the courts may decree a sale of the ship, and division of the proceeds. By the Revised Statutes of the United States, the owner or owners of a ship, which has met with or caused a disaster, through the fault of the master or otherwise, may escape all liability beyond the value of the ship, and any freight charges which it has earned by making a surrender of all interest in the vessel and freight money, if the vessel is still in existence, in whatever condition it may be. Without such surrender the owner or owners are held responsible only for an amount equal to the value of the ship and freight earnings, in the condition the ship was after the disaster.

Only vessels built within the United States, and belonging wholly to citizens thereof, and vessels which may be captured in war by citizens of the United States, and lawfully condemned as prizes, or vessels which may be forfeited for violation of the laws of the United States, being wholly owned by citizens, or vessels wrecked in the United States, and purchased and repaired by a citizen, in case the repairs cost three fourths the value of the vessel when repaired, can obtain American registry, unless by a special act of Congress granting that privilege. A vessel to be engaged in the coasting trade, or in fishing, instead of being registered must be enrolled, if of 20 tons and upward, and if of less than 20 tons it must be licensed. American laws also provide for the regular inspection of steam vessels.

The master is responsible for the proper navigation of the ship, and has all the powers necessary for that purpose. He is entitled to the obedience of officers and crew. He may, when not at the home port, contract for repairs and supplies, and may even sell the ship should necessity arise. His treatment of seamen is regulated by law. See NAVAL ARCHITECTURE; NAVIGATION; SAIL AND STEAM; SEAMEN.

Consult: Parsons, 'Law of Shipping'; Abbott, 'Law of Merchant Ships'; Reeves, 'History of the Law of Shipping and Navigation.'

Ships, Registration of. See SHIPPING, LAW OF.

Ships That Pass in the Night, the title of a widely read story by Beatrice Harraden. It achieved notoriety when it was published in 1894 to some extent, very possibly on account of its taking title. The scene is laid in a Swiss winter resort for consumptives.

Shipton, shĭp'tŏn, **Mother,** an English prophetess about whose existence there seems to be no certainty, while there is no doubt that many of the sayings attributed to her were fabricated by others. According to S. Baker, who published Mother Shipton's pretended prophecies in 1797, she was born near Knaresborough, Yorkshire, in July 1488, and baptized as Ursula Southiel. She died, according to the same authority, at over 70 years of age, but it was not until 1641 that a pamphlet appeared containing some of her alleged predictions. In 1645 all her prophecies were considered as having been fulfilled. In 1862 a prediction was made, with Mother Shipton's name appended to it, that the world would come to an end in 1881. It caused some excitement among the ignorant.

Shipworm. See TEREDO.

Shiras, shī'ras, **George, Jr.,** American jurist: b. Pittsburg, Pa., 26 Jan. 1832. He was graduated from Yale in 1853 and from the Yale Law School the next year. Admitted to the bar in his native city in 1856 he practised there until in July 1892 he was appointed associate justice of the United States Supreme Court.

Shiras, Oliver Perry, American jurist: b. Pittsburg, Pa., 22 Oct. 1833. He was graduated from the University of Athens, Ohio, in 1853, from the Yale Law School in 1856, and was admitted to the bar in that year. He served in the Civil War as adjutant on the staff of Gen. Herron in 1862-4, and then resigned to resume his law practice. He was appointed judge of the United States district court of Northern Iowa in 1882, and served until 1903, when he was retired, having reached the age limit.

Shirâz, shē'räz, Persia, in the province of Fars, lies in a high valley, 220 miles southwest of Ispahan, and is reached by lofty passes. Its nearest point is Kodijan. The city, with thousands of the inhabitants, was nearly destroyed in 1853, by earthquake. The town now rebuilt contains mosques, a bazaar, but nothing noteworthy; the suburbs are more attractive. At the north are the tombs of the celebrated poets Hafiz and Sadi. It is a centre of trade, due to its position on the commercial routes leading from the port of Bushire. Shirâz is famous for its wines and inlaid work of wood and metal, and its poets have attributed to the town every charm of surroundings — climate, produce, flowers, and people. It has extensive manufactures of silk and cotton, firearms, cutlery, glass, pottery, swords, etc. Twenty-five miles away are the famous ruins of Persepolis. Pop. 30,000.

Shiré, shē'rā, Africa, a river in the southeastern part of the continent. It rises in Lake Nyassa, and, after a course of 370 miles, flows into the Zambesi. It is navigable except where interrupted by the Murchison cataract and rapids, which have a fall of 1,200 feet. It flows through a rich agricultural country and has become an important commercial route to the lakes region. There are several Scotch and English missions and settlements in the Shiré country. Cotton and grain are the chief products. The Shiré was discovered by Livingstone (1858-63), and the district was annexed as British territory in 1889.

Shire, shēr or shīr, in the United States the more modern term county replaces this older name. Shire is an English term, still in general use in portions of England, although superseded by the modern form in many places. In the United States counties are the first division of the State, and townships the next. The use of the word shire in the States has no significance as to division; it is merely a portion of a name. Thus we have the «county of Yorkshire.» But in England this is different. Shire so used is in itself an indication that the division is a county and to speak of the «county of Yorkshire» would be redundant.

There have been stated different periods

Digitized by Google

at which, it is said, England was divided into shires. It is probable that all such statements are incorrect, and that although there exists in England a system of subdivisions known as shires, the country never was consciously so divided. If it be remembered that the Saxon people were a collection of clans and that these clans were divided into families two or three large families to the clan, the seeming inconsistency of the above statement is explained. The head of the family was head not only in a domestic way, but in every way. He was the supreme law-giver in the family. He himself was under the leadership of the head of the clan, or tribal community. These tribal communities united to form what is known as hundreds, and the hundreds united to form shires. Thus the country instead of being divided into shires was formed by the union of many separate shires, each of which was, practically, an independent kingdom. It was after this union of shires under one national head, not a spontaneous process, but one of slow and at times retrogradal growth, that the shire took its position as a subordinate part of the kingdom. As such it had at its head the shire-reeve, whence the modern sheriff. The shire-reeve preceding the Norman conquest was one of two heads of the shire organization, the other being the ealdorman (or earl), whence comes our modern alderman. The ealdorman seemed to represent the old organization and dignity of the shire when it was an independent kingdom; he shared certain offices with the bishop. But the shire-reeve was more particularly the representative of the king, and after the Norman Conquest he became purely a royal officer, with his importance considerably curtailed. He held the sheriff's tourn, an annual court to which came the vassals of the king. The appeal from this court was to the king himself, and from this appeal came the growth of the king's court, in its three branches of King's Bench, Common Pleas, and Exchequer. This court assessed taxes, also, and thus the sheriff became the financial head of the shire; to the sheriff's court, too, fell the election of knights of the shire, thus giving it the function of an assembly for the choice of shire representatives. From the time of the Plantagenet accession to the throne the importance of the shire organization decreased, the sheriff now being merely an aid to the county court (q.v.). (See COUNTY; FEUDAL SYSTEM.) Consult: J. R. Green's 'History of the English People,' Vol. I. (1870-82); 'Conquest of England' (1884); 'The Making of England' (1885); Freeman's 'Norman Conquest,' Vol. I., ch. ii.-iv. (1870).

Shirlaw, shėr'lâ, **Walter**, American painter: b. Paisley, Scotland, 6 Aug. 1838. He was brought to the United States in his second year, and began his artistic career in early manhood as a bank-note engraver. He exhibited for the first time in the National Academy of Design in 1861. After a course of seven years' study at Munich (1870-78) he adopted genre-painting as his specialty, and has also done a good deal of work in decoration and book and magazine illustration. He was one of the founders and the first president of the Society of American Artists. Since 1888 he has been national academician.

Shirley, shėr'lĭ, **James**, English poet and dramatist: b. London 18 Sept. 1596; d. there 29 Oct. 1666. He was educated at Oxford and Cambridge, and, having taken holy orders, obtained a curacy near Saint Albans. He soon after went over to the Church of Rome. Then he removed to London, became a writer for the stage, and acquired a reputation which caused him to be taken into the service of Queen Henrietta Maria. His first comedy was licensed in 1625, and from that date he produced many plays in rapid succession. In 1636 he went to Ireland to assist Ogilby in the management of the new theatre at Dublin. After his return, probably early in 1640, he wrote much, and was conceded the foremost of English playwrights. He died of exposure during the great fire. He was last of the notable series of Elizabethan and Jacobean playwrights; and his works, while frequently thin in plot and loosely constructed, are clever, suave, and abounding in fancy. Besides 37 tragedies and comedies, he published a volume of poems. His best dramas are the tragedies, 'The Traitor,' 'The Royal Master,' and 'The Cardinal'; and the comedies, 'Hyde Park,' 'The Ball,' 'The Gamester,' and 'The Imposture.' The best edition of his dramatic works is that by Gifford and Dyce (1833). Consult: Wood, 'Athenæ Oxonienses,' ed. Bliss (1817); Ward, 'History of English Dramatic Literature' (1875).

Shirley, William, American colonial governor: b. Preston, Sussex, 1693; d. Roxbury, Mass., 24 March 1771. He studied law and in 1731 came to America, settled in Boston, Mass., and there engaged in that profession. He was royal governor of Massachusetts in 1741-5, planned the successful expedition against Cape Breton in 1745, and in 1745-53 was in England, after which he returned to Massachusetts as governor. He made a treaty with the Eastern Indians in 1754, explored the Kennebec River, and erected several forts on its banks, and at the outbreak of the French war in 1755 was commander-in-chief of the British forces in North America. He planned the expedition of Gen. Prideaux against Niagara and accompanied it as far as Oswego, but was superseded in his military command and in his governorship in 1756. He was later appointed governor of the Bahamas, a post he resigned in 1770, and then returned to Massachusetts, where he lived in retirement the remainder of his life. He wrote: 'Electra,' a tragedy; 'Bertha,' a masque; 'Conduct of Gen. William Briefly Stated' (1758); etc.

Shirley, a novel by Charlotte Brontë, published in 1849. The scene is laid in the Yorkshire country, with which the author had been acquainted from childhood. The heroine, Shirley, was drawn from her own sister Emily. The book is richer in portrayal of character than in striking incident.

Shirt, the name of certain garments worn by males beneath the outer clothing. The shirt is of ancient origin, having been worn in England before the Norman conquest. It was of linen, and from being a plain and homely article of attire it gradually became one of great luxury and display, with embroidered collar, front and wrists. Shirts of silk, and shirts of mail, sometimes concealed beneath the outer

Digitized by Google

shirt, were worn in the Middle Ages, and at a much later period. The shirt reached its highest display in the later Stuart period, when it was frequently ornamented with cut work, representing historical and other scenes. The tendency has since been toward a plainness that is almost austere, the only part of the shirt visible being the spotless upper front and cuffs. In warm weather costly shirts of varied colors and light material are worn. The manufacture of shirts is an important American industry, and gives employment to many thousands of both sexes.

Shirwa, shĕr'wā, or **Tamandu'a**, a lake in southeast Africa on the frontier of British Nyassaland and Portuguese East Africa, about 80 miles southeast of Lake Nyassa. It is a secluded basin of oval shape, 60 miles long and 20 miles broad, mostly shallow and infested by hippopotami and crocodiles. Several small rivers enter the lake on the south and west, but it has no outlet. The lake lies at an elevation of 1,800 feet above the sea, and is surrounded by mountains from 7,000 to 8,000 feet high. Mount Zomba on the west shore is 7,000 feet high and 20 miles long. The surrounding country is very beautiful and clothed with rich vegetation.

Shishak, shī'shăk, Egyptian king, the Sheshenk I. of the monuments, and the first sovereign of the Bubastite or Libyan dynasty. Shishak I. rose to the throne from being commander of the powerful Libyan mercenaries; to him Jeroboam fled for protection when he fell under the suspicion of Solomon (1 Kings xi. 40); and in the fifth year of Rehoboam he invaded Judah, whose fenced cities he took one after another until he arrived at Jerusalem, which, according to the statement of Josephus, fell without a struggle. (Compare 2 Chron. xii. 1–10). Shishak pillaged the temple and the king's palace, carrying off the treasures accumulated in the reigns of Solomon and David, and reducing Judah to the position of a tributary kingdom. He ascended the throne of Egypt about 980 B.C. and reigned at least 21 years. On the southern wall of the great Temple of Karnak, in Upper Egypt, is a record of the conquests of Shishak and of the countries ruled by him. On this are four rows of prisoners. Each figure has his arms tied behind him, and a rope around his neck, and Shishak, a colossal figure, leads them by a string, meanwhile brandishing a weapon. In the lists of his conquests during the expedition in which Judah was subjected to his rule we find the names of cities in both the kingdoms of Israel and Judah and of several Arabian tribes to the south of Palestine. Among those of the cities which can be recognized in these lists are Rabboth, Taanach, Sunem, Rehob, Hapharaim Adoraim, Mahanaim, Gibeon, Beth-Horon, Kedemoth, Ajalon, Megiddo, and Judah Maluk, «the royal city of Judah,» or Jerusalem. Shishak appears to have been one of the ablest and most powerful of the Egyptian monarchs. All Egypt was under his sway.

Shittim Wood. See Kittim.

Shi'vaism, the religion of the Shivaites, or worshippers of Shiva, an ancient Dravidian divinity of Southern India. His proper name was Mahâdêwa, «greater god»; but the title Shiva, «the good,» was more generally applied to him by his votaries. While Shiva is the most popular of the Hindu pantheon, his worship more widely obtains in the south than in the north, although his throne is the Himalayas, and he is a destroying god, yet sometimes restoring and fructifying in influence. Thus in the south he is widely honored under the symbol of the phallus or lingam. Although he is a Dravidian god, in the struggle between Brahmanism and Buddhism he was adopted into the Brahmanistic system and identified with the Vedic Rudra, god of storms. Consult: Muir, 'Original Sanskrit Texts'; Wurm, 'Geschichte der indischen Religion' (1873).

Shoa, shō'ā, Abyssinia, northeast Africa, an important central province with ill-defined boundaries. It consists of a series of plateaus at 3,000 feet above sea-level, traversed by mountain chains, which, in the culminating point, Mount Metatite, near Ankober, have a height of 10,700 feet. Its east portion, called Effat, has a less elevated and more generally sloping surface, which is highly cultivated, and yields good crops of grain, chiefly wheat and barley. Cotton also is extensively cultivated. The higher plateaus are devoted to pasture. Among indigenous trees is the *Juniperus excelsa*, which in the course of a century attains a height of 160 feet, with a diameter at the base of four to five feet. The exports of the province comprise grain and large quantities of a durable cotton cloth, and to these may be added, as articles of trade, coffee, gold-dust, ivory, gums and spices, ostrich feathers, hides, dye-woods, medicinal plants, etc. Christianity was introduced as early as the 3d century, and is still professed by a large number of the inhabitants, though in a degenerate form. Pop. estimated at 2,500,000, of whom about 1,000,000 are Christians, and the rest chiefly Mohammedans. The present capital is Adis Abeba, but the chief town is Ankober.

Shoals, Isles of. See Isles of Shoals.

Shock, William Henry, American engineer: b. Baltimore 15 June 1821. He became 3d assistant engineer of the navy in January 1845, and served in the Mexican War. In March 1851 he was appointed chief engineer. In 1854–5 he superintended the construction of marine engines at West Point, and the next year was detailed as engineer of the Merrimac. He was president of the examining board of engineers in 1860–2 and became superintendent of the building of river monitors at Saint Louis during the following year. During 1863–5 he was fleet-engineer under Admiral Farragut at Mobile and later under Admiral Thatcher, and while so engaged he constructed an instrument for the destruction of floating torpedoes and torpedo electric wires. Later he became chief engineer at the Washington Navy Yard; fleet-engineer of the European squadron; in 1870–1 acting-chief of the bureau of steam engineering, which department he represented at the Vienna Exposition in 1873. In 1877 he was appointed engineer-in-chief of the United States Navy and served until 1883, when he was retired. In 1868 he invented a rotary projectile for smooth-bore guns; in 1869 a relieving cushion for wire rigging for ships; in 1870 a projectile for small arms. His 'Steam Boilers: their Design, Con-

Digitized by Google

struction, and Management' (1881) has become the standard work upon that subject.

Shock, a sudden vital depression of the body, usually due to sudden derangement of the functions of the nervous system, and generally accompanied by a dilatation of the blood-vessels of the surface of the body and a marked decrease in blood-pressure. Such a condition may be brought about by both physically or psychically acting causes. A blow, a fall, a hemorrhage, an operation, sudden fright, an appalling sight, a heartrending cry, sudden financial loss, or great and sudden bereavement, these are among the many causes constantly acting to bring about such a condition. The symptoms of shock vary greatly according to the type of cause and the individuality of the patient. Sometimes the symptoms begin at once; under other circumstances the results may be delayed for a long period. A very severe form of shock is spoken of as surgical shock. This usually results from severe operations which involve nervous structures, take much time, and large quantities of anæsthetic. A condition closely resembling surgical shock may follow the severe hemorrhage of placenta prævia, ectopic pregnancy, or other form of internal hemorrhage. (See BLEEDING.) The symptoms of shock are very characteristic. The face usually becomes blanched and pale, the body becomes cold and is covered with clammy perspiration, the hands and feet usually become icy, the brain seems to be in a whirl, and consciousness is lost or much clouded. The pulse is usually quickened; the arteries at the wrist are soft and easily compressed; the breathing is usually rapid and shallow, labored and at times irregular. The eyes are often sunken and listless, and the temperature of the body is diminished one to two degrees. The most important single factor in pure shock of the type described is the sudden fall in blood-pressure. This is thought to be due to purely nervous causes, the most potent one of which is paralysis of the sympathetic nervous fibres. This causes sudden dilatation of the blood-vessels, loss of tone of the vessel-walls, with loss of blood-pressure; hence the symptoms, and oftentimes the resultant death. Why the sympathetic nervous system should be acted on in this manner is at present unknown. Sometimes the symptoms of shock are much less severe. There is temporary faintness, slight pallor, and a feeling of nausea, and the attack passes off. Between this slight shock and the shock that results from the pugilist's «solar-plexus» blow, that may bring death, every variety of change may be noted. In severe accidents many patients, while not suffering from physical injury, are often prostrated and develop true railroad shock, or traumatic neurasthenia. (See NEURASTHENIA.) Psychical shock may induce neurasthenia; it may be a potent cause of mental disease; or it may even cause death. The influence of shock upon pregnant women is of great importance. Shock in such circumstances may bring about miscarriage, or cause malformations of the fœtus. Mild cases of shock are recovered from without aid. A stage of reaction sets in, the patient becomes warmer, the blood-vessels retain their tone, and equilibrium is restored. More severe attacks require hot-water applications to the extremities, hot tea or coffee by mouth, alcoholic stimulants, or even ergot or adrenalin. Massage and heat, and sometimes rectal injections of plain hot (110°–115° F.) water, or hot salt water (1 teaspoonful of salt to pint of water) are very useful in extreme cases.

Shoe. See BOOTS AND SHOES.

Shoe-billed Stork, or **Whale-head**, a large stork (*Balæniceps rex*) found on the White Nile. It is brownish-gray with black wings, tail and feet, the head is slightly crested, the bill short, broad and deep, with the tip hooked and mottled dusky and yellow. These birds, also known as «boat-bills,» live in flocks in swampy woods and morasses, and feed upon all kinds of small reptiles, frogs, fish, mollusks and carrion. Although they perch upon trees, the nest is on the ground, a slight lining of grass, etc., in a slight hollow. The eggs are white and from 2 to 10 in number.

Shoeburyness, shoo'bĕr-ĭ-nĕs, England, county of Essex, in marshy land at the mouth of the Thames, opposite Sheerness, 45 miles east of London; has a school of gunnery, artillery barracks, appliances for experiments in arms, guns, etc., where practical instruction in target shooting tactics, etc., is imparted to the officers and men of the British. Pop. about 5,000.

Shoeffel, Mrs. John B. See BOOTH, AGNES.

Shoe'maker, John Vietch, American physician: b. Chambersburg, Pa., 18 March 1852. He was graduated from Jefferson Medical College in 1874, and was engaged as lecturer there until 1886, since when he has been professor at the Medico-Chirurgical College of Philadelphia. He was one of the founders of the 'Medical Bulletin' in 1879 and has since been its editor. He has published various medical treatises.

Shoemaker, Michael Myers, American author and traveler: b. Covington, Ky., 26 June 1853. He spent two years at Cornell University and since 1874 has traveled extensively over the greater part of the world, making special anthropological studies. He has published 'Eastward to the Land of the Morning' (1893); 'Sealed Provinces of the Tsar' (1895); 'Quaint Corners of Ancient Empires' (1899); 'Palaces and Prisons of Mary, Queen of Scots' (1901); 'The Great Siberian Railway' (1903); etc.

Shogun, shō-goon, the highest government officer in the Japanese government during the continuance of the feudal system. He was originally a purely military officer, commander-in-chief of the army and first vassal to the emperor. The office became hereditary, and the Shoguns gradually acquired nearly all the real powers of government, leaving only the title of royalty to the emperor. The latter resided at Kioto while the Shogun held court at Yedo (Tokyo) whence he ruled in the emperor's name as his major-domo. The shogunate was abolished in 1868. See JAPAN; HISTORY.

Sholapur, shō-lä-poor', India, (1) Chief town of the district of Sholapur in Bombay, 150 miles southeast of Poona. Noteworthy are the old bazar, with a section for each day of the week; the temples of the gardens and fine tanks; the old fort and walls, the high school and the cotton mill. There are important manufactures of silk and cotton, and six print-

Digitized by Google

ing presses, publishing newspapers in as many native dialects. In 1818 the town was stormed and taken by the British.

(2) The district of Sholapur covers an area of 4,521 square miles. The chief products are millet, oil seeds and pulse. Cultivation depends largely upon irrigation (the Ekruk tank is one of the largest in the Deccan). Barsi is the principal commercial centre, and has eight cotton factories. Pomdharpur is another «Mecca.» The Great Indian Peninsula R.R. traverses the district, with branches. Pop. about 800,000.

Shooter Island, an island in Newark Bay, separated by a narrow channel from Staten Island, N. Y., one mile east of Elizabeth, N. J. It is chiefly noted for its large ship-building plant.

Shooting Stars. See METEORS.

Shore, Jane, mistress of Edward IV.: b. London; d. there 1527. She was remarkable for her beauty and cultivated in mind. Her influence with Edward was never exercised but to the benefit of others. (See EDWARD IV.) Richard III., partly to revive among the citizens the memory of the licentiousness of his brother, whom he accused of being «the chief abettor of that witch Shore,» determined to expose her to public ignominy. He declared before the council that the witchcraft of Jane Shore and her associates had withered his arm, although he was born with that member shrunk and shriveled. He was unable to effect his purpose in this manner, and directed her to be tried for adultery by the spiritual court, which condemned her to do penance in a white sheet, at Saint Paul's, before the whole people. She latterly fell into poverty, and appears to have died in 1526 or 1527. Her story appears in literature in Shakespeare's 'Richard III.'; and in a tragedy, 'Jane Shore,' by Rowe, in many old English ballads, and it has even been introduced upon the French stage.

Shore-birds, the sportsman's name for that large group of limicoline birds, as plovers, sandpipers, curlews, phalaropes, oyster-catchers, etc. (qq.v.), which are to be found along the beaches of the sea or other large bodies of water, where they seek their food at the edge of the waves. Shore-bird shooting is an amusement of the autumn and early spring, when these birds are migrating between the South and the far northern breeding-places to which most of them resort in summer, and is usually carried on by the aid of stationary decoys, and calls for skill and patience. Consult: Elliott, 'Shore Birds' (New York 1895); Seebohm, 'Geographical Distribution of the Family Charadriidæ' (London 1887); and books relating to shooting.

Shore-lark, a small bird (*Otocoris alpestris*), a native of the north of America, Europe, and Asia. Within the United States it is found in winter as far south as North Carolina and Illinois. The adult male is about seven inches long; in summer, lores, cheeks, gorget, and band on top of head, ending in erectile tufts, black; nape, mantle and upper tail coverts pinkish-brown, white beneath. The eastern or typical shore-lark breeds along the northern border of the United States and in British America. In winter it migrates southward in flocks, which frequent open fields and the seaside meadows. In the western and interior parts of the United States numerous distinct varieties occur, some of which breed in the mountains within our borders. They range as far south as Texas and Mexico. The shore-larks are closely related to the famous skylark of Europe. They nest in a depression in the ground and lay four or five eggs — French white, mottled with dull olive-green or yellowish-brown, but very variable. Nesting begins very early in the spring and several broods may be raised.

Shorey, shō'rĭ, **Paul,** American educator: b. Davenport, Iowa, 3 Aug. 1857. He was graduated from Harvard University in 1878 and was admitted to the Chicago bar in 1880. He was professor of Greek at Bryn Mawr College 1885–92, resigning in the latter year to fill a similar chair at the University of Chicago. He has published 'De Platonis Idearum Doctrina' (1884); 'The Idea of Good in Plato's Republic' (1895); 'The Odes and Epodes of Horace' (1898).

Short, William, American diplomatist: b. Spring Garden, Va., 30 Sept. 1759; d. Philadelphia, Pa., 5 Dec. 1849. He was educated at William and Mary College, became a member of the Virginia executive council, in 1785 was appointed secretary of legation at Paris, and after the departure of Jefferson, the minister in 1789, became *chargé d'affaires.* In January 1792, he was appointed minister to the Netherlands, but in December went to Madrid, whither he and William Carmichael had been detailed as commissioners plenipotentiary to treat with Spain in respect to boundaries and commerce. He became minister resident in 1794, and at the departure of his former associate concluded the negotiations and signed the treaty of friendship, commerce and boundaries 27 Oct. 1795.

Short-eared Owl, a small, nearly cosmopolitan owl (*Asio accipitrinus*), so called because its ear-tufts are inconspicuous as compared with those of its relative, the long-eared owl (*A. wilsonianus*). It is buffy, whitish, striped with dark brown, and 15 inches in total length. Its habits are those of ordinary owls (q.v.).

Shorter, Clement King, English editor. He is regarded as one of the ablest editors in London; has had charge of the 'Sketch Album' and 'English Illustrated Magazine'; became editor of the 'Illustrated London News' in 1891, and is at present editor of the 'Sphere' and the 'Tattler.' He has published: 'Charlotte Brontë and Her Circle' (1896); 'Victorian Literature: Sixty Years of Books and Bookmen' (1897); etc.

Shorter, Dora Sigerson, English author: She is the wife of Clement King Shorter (q.v.) and has written: 'Verses' (1894); 'Ballads and Poems' (1899); 'The Woman Who Went to Hell' (1902); etc.

Shorter Catechism, a catechism extensively used by English-speaking Presbyterians throughout the world, and which was framed during the time of the English Commonwealth. A Committee of Assembly was appointed 5 Aug. 1847 to prepare the Shorter Catechism, which was presented to the English Parliament

Digitized by Google

26 November, that year, and was ordered to be printed by vote of Parliament, 16 April 1648. The Scotch General Assembly adopted the catechism 16 July 1648, and the Scotch Parliament the following February ratified this action. See CATECHISM.

Shorthand (Stenography, Phonography, Tachygraphy) is a term applied to any system of contracted writing by which spoken words are recorded. The early history of this art is closely allied with palæography, and it has been traced into the mists of antiquity. Antiquarians have tried to connect it with hieroglyphics and to show that it was used more than 1,000 years before Christ by the Persians, Egyptians and Hebrews. Abbreviated writing, to take down lectures and also for the preservation of poems recited at the Pythean, Nemean and Olympic games, was practised by the early Greeks, and there are specimens of ancient Greek *notæ*, or shorthand, in the Vatican Library, at Rome, the Bibliothèque Nationale, at Paris, and the British Museum.

Ancient History.— The definite existence of shorthand reporting dates in the century preceding the Christian era. Tiro, the accomplished freedman and amanuensis of Cicero, was in 63 B.C. the first known practitioner of the art. He reported speeches of his master, which were afterward revised by the orator; and as *notæ Tironianæ* became the established name for shorthand writing its invention was subsequently ascribed to him. At that period Rome was drawing from Greece her stores of learning and art, and Tiro's system was probably an adaptation from the Greek. Plutarch informs us in his life of Cato the Younger that Cicero distributed notarii (shorthand reporters) in various parts of the Senate House on the occasion of the vote as to the fate of Catiline, the chief purpose being to take down the speeches of Cæsar and Cato. The text of those speeches may be given by Sallust in his history of the Catilinian conspiracy, chapters 51–53, or the historian may have followed the example of Thucydides and embodied in them his conception of the character and policy of the two foremost Senators. Mæcenas, the famous statesman, courtier, and patron of literature, introduced some improvements in shorthand, and, according to Dion Cassius, instructed many in the art through his freedman Aquila. Seneca afterward increased the number of notations to a total of 5,000. Scaliger made a collection of the notes of Tiro, Seneca, and others, which is appended to the great work of Janus Gruterus, published at Heidelberg, in 1603.

An illustrious German scholar, Ulrich, in 1817 analyzed the Tironian notes, and his analysis shows that Roman shorthand, though a strain on the memory, answered the practical purposes of stenography quite as well as the systems in vogue in the early part of the 19th century, such, for example, as the one sketched by Charles Dickens from his own experience in the 38th chapter of 'David Copperfield.' We are informed by Suetonius that the Emperor Augustus taught the art to his grandchildren, and that the Emperor Titus was a skilful stenographer. Martial, who lived in the time of Nero, has left an epigram upon a shorthand writer: *Currant verba licet, manus est velocior illis.* Among ancient papyri discovered 100 miles south of Cairo in 1903 by Professors Grenfell and Hunt, there is a contract with a writer of tachygraphy, made 137 A.D., whereby a slave boy was to be taught shorthand for 120 drachmæ ($24); 40 drachmæ were to be paid down, 40 more on satisfactory evidence of the progress of the boy, and the last 40 when he had become proficient.

Shorthand seems to have been much used by the early Christians. It is supposed that Saint Paul dictated to amanuenses several of his epistles, notably that to the Colossians, where Tychicus acted as shorthand writer and Onesimus as transcriber. We know that Origen in the 3d century was assisted in the preparation of his 'Commentaries on the Scriptures' by clerks who wrote in shorthand from his dictation. Saint Augustine refers to an episcopal assemblage held at Carthage late in the 4th century, at which eight stenographers were employed in relays of two. About the same period the poet Ausonius praised a youth who could write faster than his master could dictate, and, with poetic license, even faster than he could think; and in another poem expressed his admiration of the skill of the stenographers of the time. Charlemagne, king of the Franks for 46 years and likewise Roman emperor during the 14 years preceding his death in 814, possessing an amount of learning unusual in his age, endeavored to become proficient in writing Tironian notes. But the *lingua Latina* was fast giving place to the *lingua Romana*, from which the modern Romanic languages of Europe sprang. At the Council of Rheims in 813, priests were admonished to address the people in the rustic tongue. Nor was a knowledge of the art confined to the western civilization. A translation by Prof. Flügel, of Dresden, from the Arabic, narrates how a Chinese in 923 A.D., who had acquired Arabic speech and writing in less than five months, took down in shorthand from the lips of his teachers 16 books of Galen.

Modern History.— The first modern shorthand work was printed in London in 1588 and dedicated by its author, Dr. Timothy Bright, to Queen Elizabeth. The first French publication, that of Jacques Cossard, appeared in 1651. The oldest German system was published in 1679. Gurney's is the oldest living system of English shorthand. It was first issued by Mason in 1720 and improved by Thomas Gurney in 1750. Taylor's system appeared in 1786, subsequent editions of which bore the name of Odell, Harding, and so on. This system has a remarkable history of successful adaptation to continental languages. Bertin adapted it to the French, and Danzer in 1801 adapted it to the German language. Marti's tachygraphy was an adaptation of Taylor's alphabet to the Spanish language and was first published in 1800. By a royal ordinance in 1802 a chair for shorthand was established in the university at Madrid and Marti named as professor. The cortes of Cadiz first had an official shorthand report of its proceedings in 1810. Marti's tachygraphy was in 1828 applied to the Italian language by his son, who also adapted it to the Portuguese. Pereira had also, early in the century, adapted Taylor's alphabet to the Portuguese. The introduction of shorthand into Mexico and the countries of South America followed these adaptations. Amanti, an Italian, adapted Taylor's shorthand to his own language, and as modified

Digitized by Google

by Delpino it is now used by the official corps of the Chamber of Deputies. The three prevailing French systems are those of Prevost, Duploye, and Prépean, the first named being a modification of Taylor. It is estimated that the bibliography of shorthand comprises 16,000 volumes, exclusive of reissues or editions. A valuable contribution to the English branch of this subject has been made by Julius Ensign Rockwell, published by the Government as Circular of Information No. 2, Bureau of Education, Washington (1884), and Circular No. 1 (1893). The latter contains a reproduction of 112 English shorthand alphabets, extending from the first alphabetic system, that of Willis, in 1602, to the Duployan method adapted by Pernin in 1882.

A court of law in England in 1740 took the initial step in appointing an official shorthand writer. The next instance of the public recognition of shorthand in that country occurred in 1789, when the House of Commons, during the trial of Warren Hastings, called the shorthand writer to the bar and required him to read from his notes the exact words used by Mr. Burke, and thereupon resolved that Mr. Burke had exceeded his instructions in accusing Sir Elijah Impey of murder. The publication of Hansard's Debates was begun in 1803 and has become a general system of reports of representative bodies in Great Britain and her colonies. It is compiled from newspaper reports, supplemented by special reports. This system is closely followed in some of the colonies, as in New Zealand, while a method similar to that pursued by our national legislature has been adopted by the Canadian Parliament. The Hansard's report is semi-official, the speeches being submitted to members for revision, and it is subsidized by the House of Commons. The official shorthand writing for the British Parliament is confined to the committee reporting, in which Pitman's and Gurney's systems have long had governmental recognition.

The American colonies were not far behind the mother country in the use of shorthand. The Virginia Convention of 1788, called to deliberate on the ratification of the Constitution of the United States, was reported in shorthand in a meritorious manner by David Robertson, of Petersburg, Va., and in 1903 the National Shorthand Reporters' Association of the United States erected a tablet in Saint Augustine's Church, Philadelphia, to the memory of Thomas Lloyd, the official reporter of the National House of Representatives, 1st session 1st Congress. This tablet bears the following inscription:

Captain Thomas Lloyd, Author, Soldier, Patriot.
The father of American shorthand reporting.
14 August 1756 — 19 January 1827.

In 1834 Franz Xavier Gabelsberger, secretary to the ministry in Bavaria, brought out his invention, and in 1837 Isaac Pitman, of Bath, England, gave to the world the first edition of phonography, or sound hand. Gabelsberger's system, with adaptations, has been widely introduced in Austria-Hungary, Switzerland, Russia, Denmark, Norway, Sweden, Finland, Poland, Holland, Belgium, Servia, and Rumania, although in some of these countries modifications of the Stolzean method predominate. Wilhelm Stolze published his system in 1841, and it is used in the Prussian Chamber, which is the sole exception to the official use of Gabelsberger's shorthand in Germany. In Russia a translation of Gabelsberger is officially employed in the imperial senate, the court of cassation and other law courts. There was, of course, a gradual development of the art down to Isaac Pitman's invention. Dr. Bright's system was cumbrous and followed the vertical style of Chinese writing; but he indicated a present particle by two final dots just as Isaac Pitman nearly three centuries afterward denoted it by one.

Phonetics.— The phonetic principle was first applied to English shorthand by John Willis, in 1602, and it was further developed from time to time; but it remained for Isaac Pitman to make it a complete basis; in other words, to invent phonography or sound hand. As there are in the English language 43 distinct sounds, represented by 26 letters, Isaac Pitman adopted an extended alphabet by which consonants are indicated by simple geometrical strokes, straight or curved, the light sounds denoted by light strokes and the heavy ones by corresponding heavy strokes. The leading heavy vowels are represented by six heavy dots and a like number of heavy dashes, placed at the beginning, middle, or end of the strokes, and before or after as they precede or follow the consonants. The same course is followed with the light vowels. Diphthongs are provided for by a combination of dash forms, and by a small semicircle differently formed and placed in different positions. Circles, hooks, and loops are employed in distinct offices. As an illustration, the word *caught* is composed of three sounds represented by six letters. It is spelled phonetically k a w t, and in phonography it is written with two straight strokes joined, one horizontal and the other perpendicular, and a disjoined dash. In rapid writing the dash is omitted, as an important feature of the art in reporting is the use of consonant outlines, omitting vowels. It follows that shorthand is more readily adapted to a consonantal than a vowel language, and for this reason French is easy and Japanese difficult. In every case, however, many brief forms, more or less arbitrary, are used for words of frequent occurrence.

Pitman System.— As has been stated, verbatim reporting in the English-speaking world dates from the invention of phonography by Sir Isaac Pitman, for in recognition of his eminent service, the honor of knighthood was conferred on him by Queen Victoria. There was a celebration in London in 1887 known as the Golden Jubilee of Phonography, in which an array of talent was displayed which came as a surprise to men of letters on both sides of the Atlantic, who were unaware of the accomplishments necessary to make the career of a shorthand reporter successful. Sir Isaac died in 1897, after having witnessed the introduction of phonography into every land that Anglo-Saxon civilization has penetrated. The inventor received great aid from his brothers, but that of his youngest brother was conspicuous and American. Benn Pitman came to the United States in 1853 and established in Cincinnati a phonographic institute and a publishing house, which are still in successful operation. For many years he had had an able association in the person of Jerome B. Howard. In 1903, Mr. Benn Pitman having

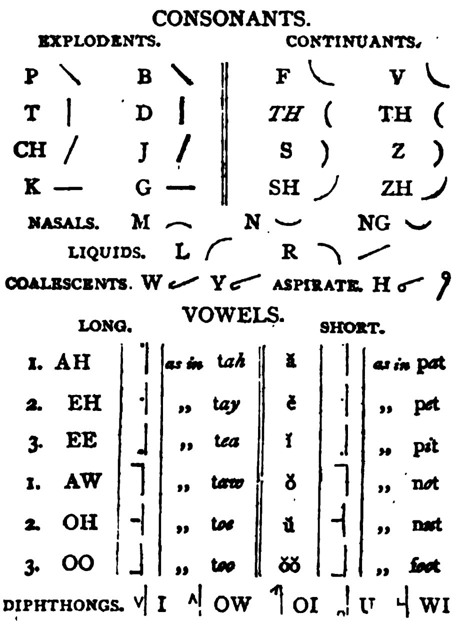
Digitized by Google

spent 50 years in the dissemination and development in the United States of his brother's invention, the National Shorthand Association, which met in Cincinnati, made an appropriate celebration of the golden jubilee of his labors.

The following is the complete alphabet of the Isaac Pitman system as presented in "Course in Isaac Pitman Shorthand" (1911):

THE PHONOGRAPHIC ALPHABET.

(BY ISAAC PITMAN.)



To these brief elementary signs, which represent every distinct elementary sound in English, are added abbreviating adjuncts and principles, that enable the hand to keep pace with thought. When Isaac Pitman invented his shorthand alphabet, and with the assistance of distinguished educators and practitioners improved it, he had a three-fold object in view:

1. To give those who had memoranda to make, a more elementary method of writing, plain, simple, easily acquired in a few weeks, and capable of being executed at the rate of 50 or 60 words a minute.

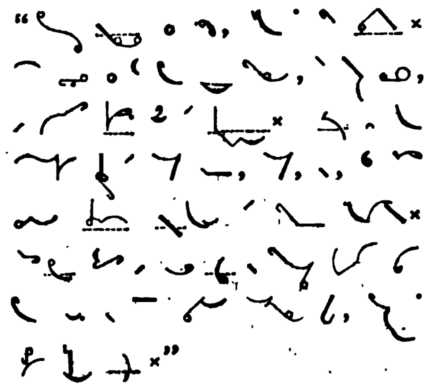
2. To develop a style of writing for the use of business men, ministers, physicians, authors, scientific investigators, and others who would acquire through a few months' study the ability to write 100 words per minute, with the ease of speech and the legibility of print.

3. To establish a system of reporting for those who sought to record the eloquent orations of public speakers at the rate of 300 words a minute when required.

How well the inventor succeeded in his realization of these first two resolves may be seen in the representation in the next column, and the history of the dissemination of the art proves that this third has also been crowned with success.

Pitman's phonography has not only been successfully adapted to such languages as the Spanish and Dutch, but even to the Malagasy for official use in Madagascar; and in 1902 Edward Gantlett made an adaptation to the Japanese languge under the title 'Phonographica Japonica.' In Japan and China a method of tachygraphy is generally employed. The separate marks which united form a character in ordinary writing are made by a single stroke of the pen, the contours being traced regardless of details. In India, Navina, of the Punjab University, invented an alphabet of new Hindi characters, which is said to form the basis of a rapid and legible system of shorthand. Other systems, based on Isaac Pitman's, have been introduced in the United States by Elias Longley, Andrew J. Graham, and James E. Munson. Mr. Graham brought out the first edition of his 'Standard Phonography' in 1858.

SPECIMEN OF ISAAC PITMAN SHORTHAND.



"As far as business is concerned, I have a particular hobby. My craze is that every young person, of both sexes, should learn at least shorthand and typewriting. Here you have mental discipline and knowledge together, knowledge, too, that is almost certain at some time to be convenient and practically available. I cannot conceive that one who knows these two branches thoroughly will ever need to go hungry in the present generation, for they have a constantly widening use."—*P. T. Barnum, in The Cosmopolitan.*

Official Use.—The enlarged use of shorthand, owing to the demands of State legislatures, courts, and the business world, is well known. The National Shorthand Reporters' Association (Willis N. Tiffany, Los Angeles, president, 1911), has an executive committee composed of reporters from 35 States, 2 Territories, and the District of Columbia. The Senate of the United States in 1848 made a contract for a verbatim report of its debates and proceedings, and the same course was adopted by the House of Representatives in the following year. Before 1848 the 'Congressional Globe' contained an abstract of the debates and such speeches in full as members wrote or had specially reported. In 1873 Congress adopted the existing method and transferred the official publication of the proceedings from private contract to the government printing office. By this method each house employs a corps of five reporters, the Senate paying to its corps $25,000 a year and the reporters of the House receiving $5,000 a year each. In addition, the House of Representatives employs a corps of official reporters of committees.

Digitized by Google

Shorthand has reached the highest possible development in every country where a parliamentary form of government has obtained. Turkey possessed no system of shorthand until her accession to the list of constitutional states, brought about by the reform movement of 1876. The Turkish Parliament met in 1877 and much difficulty was found in securing reports. Stenographers were employed to translate on the spot into French the speeches delivered in Turkish, but in this work the note-takers failed. The speakers were then required to reduce their remarks to writing before delivery; but it was found that such a rule could not be applied to a deliberative body. Efforts were then made to invent a stenographic machine, but this proved a failure there as elsewhere. Gabelsberger's system was translated into Turkish by Grünbaum, and the problem was about to be successfully solved when the Parliament was dissolved and the constitution abrogated by the will of the Sultan.

The continental countries of Europe and Great Britain are far in advance of the United States in making instruction in shorthand a material and essential part of education. In this country this knowledge must be sought by individual effort, and is gained by self-instruction or in private schools. In view of the peculiar qualifications required to excel in the art, as dexterity of hand, alertness of mind, a nervous temperament under control, this method is hardly subject to criticism. There must be, of course, rivalry and degrees of merit between different systems or different styles of the same system; but every writer adapts his shorthand to his own personality, so that a good writer may employ an inferior method and a poor one may use a superior shorthand invention.

Clarence A. Pitman, M.P.S., N.S.R.A.

Shorthorn, a breed of cattle. See Dairying; Ox.

Shorthouse, Joseph Henry, English manufacturer and author: b. Birmingham 9 Sept. 1834; d. London 4 March 1903. After a secondary education at Tottenham, he became a manufacturer of sulphuric acid at Birmingham, but found an avocation in literature, and privately printed a half-mystical work of fiction, 'John Inglesant.' This was published in 1881, was much talked of, and gained a solid success. Other works of his, such as 'The Little Schoolmaster Mark' (1883–4) and 'Sir Percival' (1886), did not encounter a similar acceptance, but are greatly prized by thoughtful readers. Besides his fiction he wrote an essay on 'The Platonism of Wordsworth' (1882).

Shortia, a genus of plants of the *Diapensia* family, containing two species, one (*S. uniflora*), in Japan, and the other a very local plant, in the Alleghany Mountains. The latter species (*Shortia galacifolia*), is an interesting plant historically, being closely associated with Dr. Asa Gray. When in Paris in 1839, Dr. Gray saw an unnamed specimen, with only leaves and fruit, in the herbarium of the elder Michaux, who stated that he had collected it in 1788, in the high mountains of Carolina. Dr. Gray afterward searched for it in that region, but was unsuccessful. He, however, described this plant, "with the habit of pyrola and the foliage of galax," and named it in honor of Dr. C. W. Short. The *Shortia* was afterward found (1877), although not in the locality mentioned by Michaux, but was in flower and was sent to Dr. Gray, to verify his classification. In 1886, almost one hundred years after it was first seen, and after much laborious searching, the *Shortia* was rediscovered by Dr. Sargent, in practically the identical region visited by Michaux. Later still it was found in such quantities that it was transplanted, and this once unknown flower is now becoming a common plant in horticulture. It has a creeping rootstock, a large tuft of long-petioled, evergreen leaves, with brownish stains, thin and serrate, and shaped very like the galax leaves used in floral decoration. There are several flower scapes, some six inches tall, bearing solitary nodding, five-merous, bell-shaped flowers an inch long and wide, with white fringed petals, blooming in the early spring.

Shortsightedness. See Vision, Defects of.

Shortt, Adam, Canadian political economist: b. near London, Ont., 24 Nov. 1859. He was educated at the universities of Queen's (Kingston, Ont.), Edinburgh, and Glasgow, and on his return to Canada became an assistant in philosophy at Queen's University, and after the establishment of the Macdonald chair of political science at Queen's was appointed to fill it. He has made a close study of Canadian economic problems as well as of English and French colonial policies, and has published in the 'Journal of the Canadian Bankers' Association' a series of papers on the 'History of Canadian Currency,' and 'Banking and Exchange.'

Shoshone (shō-shō'nē) **Falls,** a waterfall in the Snake River (q.v.), in the southern part of Idaho, about 30 miles south of Shoshone. Above the falls proper, the cañon is about 750 feet wide and 1,200 feet deep. The waters are deep and flow with scarcely a ripple until the rapids are reached, when the water spreads out fan-like and drops over numerous precipices, some 50 feet in height, then, as it were, gathers its entire volume and plunges over a precipice 210 feet in height. Below this fall the cañon is about 1,000 feet in depth.

Shoshonean Indians (adapted from *Shoshoni*, an important Shoshonean tribe, whose name is probably an opprobrious Siouan epithet). A linguistic stock of American aborigines which formerly occupied a large part of the great interior basin of the United States. On the north, Shoshonean tribes extended far into Oregon, where Shahaptian territory was met. On the northeast the eastern limits of the pristine habitat of the Shoshonean tribes are unknown; the narrative of Lewis and Clark asserts that the Shoshoni bands encountered on Jefferson River, whose summer home was on the headwaters of the Columbia, formerly lived, within their own recollection, in the plains east of the Rocky Mountains, whence they were driven to their mountain retreats by the Minitari (Atsina), who had obtained firearms, and much of whose territory was formerly occupied by Shoshonean tribes. Later a division of the Bannock held the finest portion of southwestern Montana, whence they were apparently being pushed westward across the mountains by Blackfeet. On the east the Tukuarika, or Sheepeaters, held the Yellowstone Park country, while the Washaki occupied southwestern

Digitized by Google

Wyoming. Nearly the entire mountainous part of Colorado was held by the several Ute bands, including the northern drainage of the San Juan in the southeast and extending into northeastern New Mexico. The Comanche division of the stock extended farther eastward than any other, but with the exception of the Penetehka band, this important and warlike tribe did not make its appearance in the southern plains until the beginning of the 18th century, although they later extended their raids throughout the greater part of Texas and far into Mexico. On the south, Shoshonean tribes were limited generally to Colorado River in Arizona and California; the Chemehuevi occupied both banks of that stream above and below Bill Williams fork, and the Kaibabs, Shivwits, and Kwaiantikwokets (Paiute divisions) occupied northwestern Arizona and southwestern Utah. The pueblo-dwelling Hopi or Moki occupied seven villages in northeastern Arizona in the middle of the 16th century, some of which were subsequently abandoned and new ones established, and about the close of the 17th century Tewa Indians of Tanoan stock from the Rio Grande established the pueblo of Hano among the Hopi (see TUSAYAN). In the southwest, Shoshonean tribes had pressed across California, occupying a wide belt of country to the Pacific. In their extension northward they had reached as far as Tulare Lake, from which territory they had apparently dispossessed Mariposan tribes. A little farther northward they had crossed the Sierras and occupied the heads of San Joaquin and Kings rivers; they also occupied nearly the whole of Nevada, and the entire southeastern part of Oregon was likewise inhabited by tribes of Shoshonean extraction.

Owing to the vast extent of country occupied by these tribes, which ranged from timbered mountains to desert plains, with great difference in climatic conditions, their habits and customs greatly varied. The northern and eastern members of the stock — the Bannock, Shoshoni, Ute, and Comanche — were hunting Indians, living in tipis and subsisting almost entirely on large game, including the buffalo; but of these tribes only the Comanche were essentially «Buffalo Indians.» Most of the western tribes of the stock, notably the Paiute, inhabited in the main an inhospitable desert region which afforded scant subsistence in the way of seeds, berries, roots, fish, and small game. The necessity of digging roots for food early earned for them the sobriquet «Diggers,» a name still applied to the Paiutes and their relatives in eastern California, western Nevada, and western Utah, particularly those not under official control. Living in rude brush shelters or sometimes even in holes in the ground, and living on the meager natural products of the desert, these Indians have been regarded as in some respects among the lowest in the culture scale of the tribes of the United States, although some of the Paiute divisions and the Chemehuevi practise agriculture to some extent. The Hopi or Moki, whose country in northeastern Arizona was the Province of Tusayan (see TUSAYAN) of the early Spaniards, are much farther advanced than any of the Shoshonean tribes, due probably to a large infusion of eastern Pueblo and other foreign blood; they live in permanent adobe houses, have a highly developed social and religious system, successfully cultivate the sandy soil, and have earned just renown as potters, weavers, and basket-makers.

The population of the Shoshonean tribes approximates 16,000, distributed as follows: *Bannock*, about 500 under Fort Hall agency and 100 under Lemhi agency, Idaho; total, 600. *Chemehuevi*, 250 under Colorado River agency, Arizona. *Comanche*, 1,409 under Kiowa, Comanche, and Wichita agency, Oklahoma. *Hopi*, or *Moki*, 1,841 (including Tewa), in seven pueblos in northeastern Arizona. *Paiute* (including many small bands), 200 near Fort Bidwell, Cal.; 656 on Pyramid Lake reservation; 413 on Walker Lake reservation, and 223 under Western Shoshoni agency, Nevada; 107 under Klamath agency and 78 under Warm Springs agency, Oregon; 100 at Saint George, Utah; to which should be added 128 Shivwits and 150 Kaibabs near Saint George, Utah, and between 3,500 and 4,000 (including Gosiute, Paviotso, etc.) in southeastern California and western Nevada; total about 5,800. *Shoshoni*, about 900 under Fort Hall agency and 300 under Lemhi agency, Idaho, 223 under Western Shoshoni agency, Nevada; 804 under Shoshoni agency, Wyoming; total about 1,327. *Tobikhar* (including Kawia), about 2,300 classed as «Mission Indians» under the Mission Tule River agency, California. *Tukuarika*, or *Sheepeaters*, 98 under Lemhi agency, Idaho. *Ute*, 941 Capote, Moache, and Wiminuchi under Southern Ute agency, Colorado; 457 Uinta, 820 Uncompahgre, and 371 White River Ute under Uinta and Ouray agency, Utah; total 2,589.

F. W. HODGE,
Smithsonian Institution, Washington.

Shot. See PROJECTILES.

Shoulder-girdle. See SHOULDER-JOINT.

Shoulder-joint, the articulation of the upper arm or humerus with the glenoid cavity of the scapula or shoulder-blade. This joint is an example of the enarthrodial or ball-and-socket joints; the ball-like or rounded head of the humerus working in the shallow cup of the glenoid cavity. The head of the humerus is very large when compared with the glenoid or receiving cavity. The capsule which surrounds and encloses the joint is of very loose nature, but is intimately connected with the muscles which are attached to the head of the humerus. The joint itself is guarded against dislocation or displacement by the strong ligaments surrounding it, as well as by the tendons of its investing and other muscles; while superiorly the acromion and coracoid processes of the scapula form an arch, together with the coraco-acromial ligament, which further serves to protect the joint. The shoulder arch or girdle, also called pectoral arch or girdle, is in vertebrates — in mammals, none above monotremes (see MONOTRAMATA) — usually attached to the sternum ventrally, and to it the fore limbs are articulated. It has only an indirect connection with the vertebral column. Rudimentary or greatly modified in the majority of mammals, this girdle is especially marked in certain groups of birds (see ORNITHOLOGY). In man the clavicle is completely developed, and with the scapula this forms the bone-structure of the shoulder-girdle, which, relatively, is endowed with superior strength.

The articulating surfaces of the shoulder-joint

Digitized by Google

are covered with cartilage. The capsular ligament forms the chief ligamentous structure. It serves chiefly to support the inner and upper portion of the glenoid ligament, which is fixed around the margin of the cavity of that name. Its function is chiefly that of deepening the cavity by adding to its circumference, and it also protects the bony edge of the cavity. The motions of the shoulder-joint are limited and controlled by the interlocking of the bones, as well as by the tension of the capsule. The biceps muscle, in the relations of its tendons to this joint, subserves several important uses. Primarily, and from its connection with both elbow and shoulder-joints, it brings the movements of both into harmonious relation; while it strengthens the upper portion of the articular cavity, and steadies the head of the humerus, through its relation to the bicipital groove of that bone.

This joint is liable to various diseases and injuries. Local injury may result in inflammation, while diseased conditions of constitutional origin may give rise to strumous or scrofulous disorders of the joint, to syphilitic lesions, and to gouty or rheumatic attacks. Of the accidents to which the joint is liable, dislocations are by far the most frequent, while fractures are not uncommon. Fracture of the acromion process of the scapula, of the coracoid process, of the neck of the shoulder-blade, and of the upper part of the humerus are of most common occurrence among these accidents.

Shovel-nose. See STURGEON.

Shov'eller, or **Spoonbill,** a freshwater duck (*Spatula clypeata*), distinguished by the bill being longer than the head, and narrowed at its base, while the tip is hooked and broadened, and its fringe-like processes are long and slender. The average length of this bird is about 18 or 20 inches. The male has the head and upper neck bright green, and the lower neck white. The scapular feathers are white. The back is brown, the primary wing-feathers blackish-brown. The tip of the wing is pale blue, as also are the wing-coverts. The tail and upper tail-coverts are black. The breast and belly are light brown or chestnut. It feeds on worms, insects, snails, small fishes, and vegetable matters, and inhabits lake-margins and marshy spots, and breeds numerously all over the northern half of North America, as well as in Northern Europe and Asia, making its nest on the ground.

Shra'dy, Henry Merwin, American sculptor: b. New York 24 Oct. 1871. He was graduated at Columbia (1894), studied law, went into business, and finally taking up sculpture as an amateur, developed himself, without the direction of any teacher, into a professional sculptor, being successful in a competition for the execution of an equestrian statue in Brooklyn ($50,000) 1901; of the «Grant Memorial» for Washington ($250,000) 1902; while he was subsequently commissioned by the Holland Society of New York to make an equestrian statue of «William the Silent.»

Shrap'nel, Henry, British soldier and inventor: b. 1755; d. 1842. He entered the Royal Artillery in 1779, served with the Duke of York's army in Flanders, and shortly after the siege of Dunkirk invented the case-shot known by the name of shrapnel-shells, an invention for which he received from government a pension of $6,000 a year in addition to his pay in the army. He attained the rank of lieutenant-general in 1821; and retired in 1825.

Shrapnel. See PROJECTILES.

Shreve, shrēv, **Henry Miller,** American inventor: b. Burlington County, N. J., 21 Oct. 1785; d. Saint Louis 6 March 1854. Early in life he engaged in navigation on the Western rivers, and in 1815 ascended the Mississippi to Louisville, Ky., in the Enterprise, the first river steamboat. In 1820 he built the Washington, of 400 tons burden; remodeled it in 1824, so as to operate each of the side wheels with a separate engine; invented the snag boat Heliopolis, for removing snags from rivers; and in 1829 patented a steam battering ram for harbor defense. In 1826 he was made superintendent of improvements in Western rivers, and continued in that office till 1841.

Shreveport, shrēv'pōrt, La., city, parish-seat of Caddo parish; on the Red River, and on the Houston & S., the Kansas City Southern, the Shreveport & R. R. Valley, the Saint Louis Southwestern, the Texas & P., and the Vicksburg, S. & P. R.R.'s; about 325 miles northwest of New Orleans and about 15 miles from the Texas boundary. It is the commercial and industrial centre of the northwestern part of the State. It was incorporated as a city in 1839. During the Civil War, from the time Baton Rouge was captured by the Union forces until the close of the war, Shreveport was the capital of the State. It is in a rich agricultural region in which cotton is the chief product. There are several cotton compresses, cottonseed-oil mill, machine shops, railroad shops, ice factories, lumber and stock yards. Its railroad facilities and opportunities for river transportation give it special advantages as a shipping point and as a jobbing place. The chief exports are cotton products, live stock, hides, wax, wool, lumber, and ice. The principal public buildings are a government building, parish court-house, headquarters of the State board of health, and a hospital. There are 12 churches, and public and church schools. There is one private bank; the three other banks have a combined capital of $450,000. Pop. (1910) 28,015.

Shrew, one of the minute mammals of the family *Soricidæ,* and order *Insectivora.* The shrews have hairy mouse-like bodies and ordinary feet formed for running, and not for burrowing, as in the allied moles; the eyes and ears are comparatively well developed. They live on the ground, though a few are arboreal and others aquatic. The jaws are prolonged, and a mobile snout generally exists. There are six upper and four lower incisors, the middle pair of the upper jaw being long and curved. The first lower incisors project horizontally and form with the upper ones a forceps-like structure for the grasping of small insects, which form the larger part of their fare. This family is much the largest one of the Insectivora and the numerous species are found in most parts of the world and present many interesting adaptations.

Within the limits of the United States four genera and about 60 species occur. In the typical genus *Sorex* the ears are large and of normal conformation and the feet are not fringed

Digitized by Google

with stiff hairs. The common shrew (*S. personata*) is a frail little creature less than three inches long with a scantily-haired tail measuring one inch and may readily be distinguished by its prolonged muzzle, and by the teeth being colored brown at their tips. It feeds upon insects and their larvæ, and inhabits dry places, making a nest of leaves and grasses. The young, numbering from five to seven, are born in the spring. These little animals are very voracious in their habits, and frequently kill and devour one another. *Neosorex* has large feet fringed with stiff hairs and includes the large water shrew (*S. palustris*), six inches long, as well as several other species. It lives in burrows leading to the water, which it enters in search of snails, etc., upon which it largely feeds. This species is found chiefly in the Rocky Mountain region and central plateau.

Blarina is a characteristically American genus with mole-like fur and the external ear well developed but turned forward in such a manner as to cover the opening and conceal itself among the hair. The short-tailed or mole shrew (*B. brevicauda*) is the best known species of shrew in the eastern United States. It is about 4½ inches long with a hairy tail measuring one inch. In general habits it resembles *Sorex*. During the winter it remains quite active and is frequently found on the surface of or burrowing in the snow. At this season it feeds largely on beechnuts as well as hibernating chrysalids and larvæ. It is a blood-thirsty creature and when confined attacks and devours its own kind as well as mice larger than itself. Like other shrews it has upon the knees and elbows glands, the secretion of which give it a peculiar and disagreeable odor.

Among interesting exotic species the following may be mentioned: the European and Asiatic water shrew (*Crossopus fodiens*) attains a total length of from 4½ to 5 inches. The fur is of delicate texture, and adapted to resist the action of water. A prominent fringe of stiff white hairs is found on the tail as well as the toes of this form, this fringe forming a distinctive feature of the species. The teeth are also fewer than in the American water shrew. The food resembles that of the common shrew, but aquatic larvæ and the young of fishes appear to form a large part of its nutriment. They are of very active habits, diving and swimming with great facility. The musk-shrew (*Crocidura cærulea*) of India is remarkable for the strong musky odor which emanates from glands situated on the sides of the body. It enters houses at nights to feed upon cockroaches. Resembling the *Soricidæ* are the elephant-shrews (*Macroscelidæ*). They have the zygoma and auditory bulla developed and the muzzle forms a slender proboscis-like organ with the nostrils at its tip. The eyes are of moderate size, and the ears well developed and covered with hairs. The fore feet are short, and possess five toes, while the hind legs and feet are very long, and are provided with compressed claw-like nails. The tail is elongated and slender. The elephant shrews or jumping shrews are confined to Africa. The favorite attitude of these creatures is a sitting posture, much resembling that of the jerboas and kangaroos, and from the greater length of the hind as compared with the fore limbs they also, like these animals, progress by leaping. They inhabit dry rocky situations, feed on insects and other small Invertebrata and are nocturnal. Consult: Dobson, 'Proceedings Zoological Society' of London (1890); Dobson, 'Monograph of the Insectivora' (London 1882–90); Merriam, 'Mammals of the Adirondack Region' (New York 1884); and Merriam and Miller, 'North American Fauna No. 10' (Washington 1895).

Shrew-mole, a large mole (*Scalops aquaticus*) inhabiting wet meadows and the borders of marshes and streams throughout most of North America. See Mole.

Shrewsbury, shrooz'bŭ-rĭ, England, the county-seat of Shropshire, on the left bank of the Severn, 32 miles northwest of Birmingham. The town is unusually picturesque. The bridges are interesting features, four of them spanning the river, which here takes a winding course around the hills. The streets are narrow and steep, and bordered by old frame houses. An archway of the period of James II., and two towers of the reign of Edward I., are parts of the old castle built by Roger de Montgomery. Saint Mary's, an interesting church of the 10th century; Saint Giles'—dates from the reign of Henry I.;—Holy Cross, early Norman; and Saint Alkmonds are the most noteworthy churches. The other public buildings are public halls, museum, free library, market-house—including corn exchange—barracks, and Royal Grammar School. The industries include glass-staining, agricultural implements, foundries, tobacco, tanning, and brewing.

Shreyvogel, shrī'vō-gĕl, **Charles,** American artist: b. New York 4 Jan. 1861. He was successively gold engraver, die sinker, and lithographer. From 1886 to 1889 he studied painting in Munich under Frank Kirchbach and Carl Marr, and returning to New York was awarded the Thomas B. Clarke prize at the National Academy of Design for his oil painting 'My Bunkie.' He also won a medal at the Paris Exposition in 1900. The best known among his other paintings, most of which deal with Western frontier life, are the 'Last Stand' and 'How Kola.'

Shrike, or **Butcher-bird,** a bird of the passerine family *Laniidæ,* and especially of the typical group *Laniinæ;* several other sub-families are not represented in North America. The true shrikes have the bill broad at the base, and hooked and toothed at the tip, resembling the bill of a bird of prey. A dense tuft of bristles surrounds the nostrils and others project from the base of the bill. The feet are small, and, except for the laterally scutellate structure, are of typically passerine type. The shrikes feed chiefly upon insects, reptiles, small mammals, and small birds and their young. About 200 species of shrikes are found in all parts of the world, and four species of *Lanius* within the United States. The loggerhead shrike (*L. ludovicianus*) is the usual summer species of the eastern United States, where it is resident southerly and migratory in the North. These birds are seen usually in pairs flitting about the borders of woods and along fence-rows. The food consists chiefly of insects which the male is said sometimes to impale on thorns. They also at-

Digitized by Google

tack the young of other birds. The nest is generally built in bushes and is of large size, and composed of grass and weeds lined with hair and feathers. The eggs, usually five in number, are white, tinted with green, and spotted with brown of various hues. The loggerhead shrike is eight or nine inches long, slate-colored above, and plain ashy white below, with a black stripe through the eyes and meeting across the forehead. In the West it is replaced by two sub-species, the white-rumped and the California shrikes.

The Great Northern shrike (*L. borealis*) is found in the United States only in winter, and breeds in British America. It is nine to ten inches long, marked below with numerous fine, wavy, dusky lines, and the eye stripe is interrupted on the forehead. The nest is built in trees, and the four to six eggs are similar to those of the loggerhead shrike. The song is harsh, but this bird possesses considerable imitative powers. The food consists of mice, shrews, insects, and in winter especially of small birds. This species especially has a habit of suspending its prey upon thorns or fence splinters, or in forks of tree-branches. The significance of this remarkable habit is not understood. By some it is believed to be a storage of food; by others only an effort at convenience in eating the prey.

Closely related species of shrikes with similar habits occur in Europe, and more distinct ones in other countries. The *Oreœca cristata* of Australia lives chiefly on the ground, and is noted for its peculiar and somewhat ventriloquial song, which begins with low notes, and gradually increases in height and power so as to delude the hearer into fancying that the songster has been gradually coming from a great distance toward him. It is sometimes called the bell-bird. The piping-crow (q.v.) and the pied crow-shrike (*Strepera graculina*), of New South Wales, represent a distinct sub-family. Various other birds have been named "shrikes," of which the most important are the bush-shrikes which belong with the ant-birds in the family *Formicariidæ*. Consult: Gadow, 'Catalogue of the Birds of British Museum,' Vol. XV. (London 1890); Evans, 'Birds' (London 1900).

Shrimp, a small decapod crustacean (see DECAPODA; CRUSTACEA) of the genus *Crangon*, and looking like miniature crayfish. They inhabit sandy coasts, and in Europe are caught for market in immense numbers by nets when swimming about near the beach at high tide. The familiar British species is *C. vulgaris*. A related species (*C. franciscorum*) is found on the California coast where it has considerable commercial importance, being gathered and dried by the Chinese. The red color exhibited by shrimps when prepared for the table is the result of a chemical change during cooking, they being naturally translucent and colored much like the sand in which they live. A very great number of crustaceans more or less closely related to the shrimps live in the sea and a few in fresh water. Consult Stebbing, 'Crustacea' (New York 1903).

Shrine, the case in which holy relics are kept. Shrines are usually richly ornamented with gold, precious stones, and elaborate carvings. The earliest form of shrines was that of the diminutive model of a Gothic church with high-pitched roof. Some shrines, as that of St. Alban, Britain's protomartyr at St. Albans, that of St. Edward the Confessor at Westminster, of St. Genevieve at Paris, were imposing architectural structures. The shrine of St. Charles Borromeo in the Duomo of Milan is of beaten silver faced with rock-crystal.

Shrop'shire, a breed of sheep (q.v.).

Shroud, a word derived from the Anglo-Saxon "scrud," a garment, and meaning more especially the winding-sheet in which it was customary to wrap the dead. This custom has been generally abandoned, and the dead are buried in ordinary clothing, retaining to the last as far as possible the aspect they presented in life. The shroud has figured in many ghost stories.

Shrouds, large ropes stretched from the heads of the lower masts to both sides of a ship, to support the masts, and named according to the masts to which they belong, the main, fore and mizzen shrouds.

Shrove'tide, the three days between the evening of the Saturday before Quinquagesima and the morning of Ash Wednesday; so called because anciently people were wont on those days to make confession of their sins and to obtain absolution (to be *shriven*) in preparation for the season of Lent. The Tuesday of Shrovetide is called Shrove Tuesday; its evening was given up to merrymaking and to feasting on pancakes and fritters: hence the name Pancake-Tuesday or Pancake-night: in French Shrove-Tuesday is Mardi-Gras (q.v.).

Shrubs are woody-stemmed plants, which, according to some writers, are less than five times the height of a man. They often have several slender main stems, and branch close to the ground, retaining these lateral shoots, which are lignified, and bear fruit repeatedly. The lines of difference between herbs and shrubs, and shrubs and trees, are arbitrary and difficult to define exactly. Undershrubs are those perennials which send up from underground stems annual shoots that do not become woody, and die off in the autumn as do those of *Salvia pratensis*. The young shoots of such undershrubs as *Galium* often weave bushes together. A semi-shrub is practically the shrubby herb, whose yearly shoots only become woody at the base, before the next period of vegetation, and which wither and die off above this. The small shrub is a low or even trailing plant like the *Deutzia gracilis* and *Epigæa repens*. When larger and much branched, the shrub is called a bush; and when so large as to resemble a tree, as the syringa often is, it becomes arborescent. Some of the shrubs are even climbing plants, like the *Celastrus scandens* and certain roses. Like trees, shrubs may be deciduous or evergreen, and are often thorny. They are apt to grow in almost impenetrable thickets, with interwoven branches, and form fringes of vegetation on forest edges, in swamps, fields, and moors. They are extremely useful to the horticulturist for their flowers and for their fruits, often of economic value; and to the landscape gardener, for concealing fences and buildings, and for softening the edges of trees masses.

Digitized by Google

Shubrick, shŭ'brĭk, John Templar, American naval officer: b. Bull's Island, S. C., 12 Sept. 1788; lost at sea in the sloop of war Epervier, 1815. He entered the navy as midshipman in 1806, served on the Chesapeake in her encounter with the Leopard in 1807, and in 1812 was promoted lieutenant. He was assigned to the Constitution, participated in her engagement with the Guerriere in 1812 and was later on the Hornet during her engagement with the Peacock in 1813, receiving medals from Congress for his services. He was second lieutenant of the President when she was captured in 1815 and in the war with Algiers in that year was lieutenant of the Guerriere, the flagship of Commodore Decatur, with whom he was engaged in all the movements against the Barbary powers. Upon the conclusion of peace he was commissioned to bear the treaty to the United States. He sailed in command of the Epervier early in July 1815 and was never again heard from after passing Gibraltar.

Shubrick, William Brandford, American naval officer, brother of John Templar Shubrick (q.v.): b. Bull's Island, S. C., 31 Oct. 1790; d. Washington, D. C., 27 May 1874. He entered Harvard in 1805, but was appointed midshipman in 1806. He attained rank as lieutenant in 1813, was placed in command of a gunboat in Hampton Roads, was engaged in the defense of Norfolk and the navy yard at Gosport and later in that year was transferred to the Constitution. He participated in the capture of the Cyane and the Levant by that vessel and was voted a sword by his native State and a medal by Congress in recognition of his services. He sailed around the world in the Washington in 1815–18, the first United States vessel to make that cruise, was appointed commander in 1820 and served until 1826 in command of the navy yards at Charlestown, Mass., and at New York. In 1826 he was appointed to the command of the Lexington, was commissioned captain in 1831, and in 1838–40 was in command of the West India squadron. He had charge of the Norfolk navy yard in 1840–3, was chief of the bureau of clothing and provisions for the navy in 1845–6, in the latter year was appointed to command the Pacific squadron, captured several ports during the Mexican War, and in 1852 was appointed to the lighthouse board. He was in command of the Atlantic coast squadron for a time in 1853, and then resumed his duties as chairman of the lighthouse board, in which post he remained until his retirement with the exception of 1858–9, when he was in command of the Brazil squadron and Paraguay expedition. He was retired in 1861, but remained on the advisory board until 1870; and in 1862 he was commissioned rear admiral.

Shufeldt, shoo'fĕlt, **Robert Wilson,** American surgeon and biologist: b. New York 1 Dec. 1850. Graduated at Cornell University 1874; at the medical school of Columbia University in 1876. He served in the Civil War; was surgeon with Generals Merritt, Crook, and Sheridan in frontier Indian wars 1876–1881; curator Army Medical Museum, Washington, 1882; honorary curator Smithsonian Institution 1895; member of numerous learned societies in the United States and Europe. Has written 'Anatomy of Birds' (1882); 'Osteology of Auria Calvia' (1885); 'The Myology of the Raven' (1890); 'Lectures on Biology' (1892); and various other works.

Shumla, shoom'lā, or **Schumna,** Bulgaria, a town 56 miles west of Varna, surrounded by the hills of the Balkans. It is by the formation of its surroundings a natural stronghold. A series of outworks, strong redoubts, a citadel, and batteries have been added to its defense. Furthermore several roads, military and otherwise, radiating from this point, lend to it additional importance. Much business is transacted around the large Square. Interesting features are the mosques; a fine mausoleum (18th century) of the Grand Vizier Djezzar-Hassan-Pasha; the barracks, and the baths. Shumla is the residence of a Greek archbishop. There are important manufactures of copper, silk, leather, clothing, and slippers, and an extensive trade. The Russians made three unsuccessful attempts to capture the town; it capitulated, however, in 1878.

Shurtleff, shĕrt'lĕf, **Ernest Warvurton,** American poet and clergyman: b. Boston, Mass., 4 April 1862. He was graduated from Andover Theological Seminary in 1888, held Congregational pastorates at Palmer and Plymouth, Mass., and since 1899 has been pastor of the First Congregationalist Church in Minneapolis. He has published 'Poems' (1883); 'Easter Gleams' (1883); 'Shadow of the Angel' (1896); etc.

Shurtleff, Roswell Morse, American artist: b. Rindge, N. H., 14 June 1838. He was graduated at Dartmouth College in 1851; worked at lithography and drawing on wood till 1861, when he enlisted with the 99th New York Volunteers, of which he became lieutenant and adjutant. He was the first Union officer wounded and taken prisoner in the war, 19 July 1861, and was not released until after nearly eight months' imprisonment. Illustration of books and magazines absorbed his efforts for many years, but he began to paint in 1870 and has executed numerous landscapes in both water and oil, largely transcripts of scenery in the Adirondacks.

Shurtleff College, located at Upper Alton, Ill. It was founded by the Baptists and first opened to students in 1827. The organization includes a preparatory department, a collegiate department, and a Divinity School. Normal, commercial, music, and art courses are also provided. There are two regular college courses leading to the degrees of A.B. and B.S., respectively. The theological course is two years in length. All departments, including the theological department, are coeducational; in 1902–3 there was one woman in the Divinity School. In 1910 the buildings were valued at $100,000, the productive funds amounted to $161,233, and the annual income to $22,418. The library contained 12,000 volumes; and the students numbered 129, of whom 72 were women.

Shuster, shoos'tĕr, or **Shûshtar,** Persia, in the province of Khuzistan, on the Karun, 250 miles southwest of Ispahan. It is a walled town, defended by a castle. It is favorably situated for commerce. The houses, of stone, are built with two stories underground. Wandering tribes,

Digitized by Google

which generally camp with their flocks and herds in the vicinity during the winter, add considerably to the population. The inhabitants are noted for their hospitality. The site of the ancient Susa is not far from Shuster. Pop. 5,000.

Shut-in Society, an American organization established in order to soften the lot of invalids by supplying various desirable objects which might otherwise be unattainable. Local societies, besides supplying their sick members with fruit, flowers, reading material, medicines, and nourishing foods, also undertake to supply easy-chairs and other helps to convalescence.

Shut'ter, Marion Daniel, American Universalist clergyman: b. New Philadelphia, Ohio, 4 Aug. 1853. He was graduated from the University of Wooster, Ohio, in 1876, from the Baptist Theological Seminary, Chicago, in 1861, and was ordained in the Baptist ministry. He was in charge of the Olivet Baptist Church, Minneapolis, for some years, but afterward changed his views and became pastor of the First Universalist Church there. He has published: ‹Wit and Humor of the Bible› (1892); ‹Justice and Mercy› (1894); ‹Applied Evolution› (1900); etc.

Shuttle, an instrument used by weavers for shooting or passing the thread of the weft from one side of the web to the other, between the threads of the warp. It is a boat-shaped piece of wood which carries a bobbin or cop containing the yarn of the weft or woof. The shuttle sometimes has wheels to facilitate its motion.

In a sewing machine, the sliding thread-holder which carries the lower thread between the needle and the upper thread, to make a lock stitch. In hydraulic engineering, the gate which opens to allow the water to flow onto a wheel. That side of the wheel which receives the water is known as the shuttle side.

Shylock, a character in Shakespeare's ‹Merchant of Venice.› He lends Antonio, a merchant of Venice, 3,000 ducats on condition that in the failure to pay in three months the forfeit shall be a pound of the merchant's flesh cut off wherever Shylock chooses. His purpose is defeated by Portia, representing a young lawyer equipped with the opinion of Bellario, a learned doctor of Padua. Up to the time of Macklin, who played Shylock in 1741, the part had been always represented by the low comedian, and was given a broadly humorous interpretation. Macklin invested it with tragic qualities and represented the Jew as a revengeful, inexorable money lender. In 1814 Edmund Keane presented the part so as to elicit sympathy for one who was ill-used by circumstances. Present opinion concurs in that he was the victim of a quibble and that even on the point of his conspiracy against the state his conviction was of doubtful propriety.

Si-kiang, sē-kē-äng', or **West River,** China, the most important of the streams which unite to form the Canton River. It rises in the province of Kwang-si, and is navigable for vessels drawing 12 feet 75 miles from the sea. It is also called the Blue River, from the remarkable purity and clearness of its waters. By it are conveyed the sugarcanes that grow in the vicinity, as well as the rafts of timber from the forests of Kwang-si to the markets of Canton.

Sia (sē'ạ) **Indians,** a Pueblo tribe of New Mexico. See QUERES.

Sial'ogogue, any medicine which promotes the flow of saliva. Such medicines are either vegetable or mineral. The former embrace most of the pungent plants, particularly sorrel, tobacco, pellitory root, and mezereon; the latter, several of the metals, when taken constitutionally, especially mercury. The first are called masticatories, because the effect is produced merely by chewing.

Siam, sī-ăm' or sē-äm', an independent kingdom of southeastern Asia, bounded on the west and northwest by Burma, on the east and southeast by the French possessions of Tonkin, Anam and Cambodia, and on the south by the Gulf of Siam. The boundary on the northwest was delimited in 1891, and in 1893 the Mekong River was made the boundary on the French side for a considerable distance. France also has the right to erect stations on a certain portion of the west bank of the Mekong. The integrity of the kingdom was provided for by an Anglo-French agreement concluded in 1896. The total area of the country, within the boundaries, is about 244,000 square miles, of which about one quarter is in the Malay Peninsula. The population is very imperfectly known, and the estimates vary between wide extremes. The population of Siam within its present limits may be about 6,000,000.

Topography.— The surface of the country is mountainous in the north, the mountains being branches of the great Himalaya system; the northeastern and eastern parts are still very imperfectly known. Southward, the country consists of a vast plain. Off the coasts at a distance of 10 or 15 miles are numerous islands, mostly rocky, and considerably elevated. There are, besides numerous small rivers, two great navigable streams — the Menam or Meinam, and the Mekong. Of these the Menam is the most important, as intersecting the greater part of Siam proper, and almost monopolizing its trade and navigation. It rises by two chief branches in the Laos country in the north of the kingdom, has an estimated course of 800 miles, and falls into the Gulf of Siam by three channels 18 miles (in a direct line) below Bangkok. All the Siamese rivers are flooded between June and September, and to this circumstance is mainly due the fertility of their basins. The climate of so extensive a country varies, of course, with the latitude and the elevation of its surface; but, as in other tropical countries, it has two seasons, the wet and the dry, the former beginning in April or May, and continuing till about the commencement of July, when the dry season sets in and lasts till the following April or May. The mean temperature at Bangkok is about 81°; maximum, 97°; minimum, 54°. On the whole the country is healthy, though in the wet season ague and cholera are prevalent.

Minerals.— Gold is extensively diffused, and is obtained in tolerable purity. Tin, iron, copper, and lead are abundant, and are wrought, especially the two former, on a large scale by the Chinese. Zinc and antimony are found to the

Digitized by Google

east of the Menam. The sapphire, oriental ruby, and oriental topaz are found in the hills of Chantibun, on the east side of the gulf.

Vegetation.— Rice and maize are the grains most extensively cultivated in the country. Of the tropical farinaceous roots the Siamese raise the usual varieties, and among others the sweet-potato. Cocoa and areca palms are numerous, especially the former, in the lower districts; and the oil is extensively exported. No part of the East is more celebrated for the abundance and quality of its fruits. The mango, mangosteen, litchi, durian, pomegranate, guava, pineapple, and, in short, all the fruits of southeastern Asia, the Indian Islands, and tropical America, are abundant and of exquisite quality. The cultivation of the sugarcane is carried on on an extensive scale. Black pepper of good quality, tobacco, and cotton of several sorts are largely produced. Sappan-wood is procured extensively from the forests between lat. 10° and 13°, and in point of quantity it forms one of the most considerable of the Siamese exports. Excellent teak-timber abounds in the forests of Upper Siam, and is much used in the construction of junks and temples.

Animals.— Among carnivorous animals are the tiger and leopard, the bear, otter, the musk-civet, the cat and the dog, both wild and domestic. Porcupines, squirrels, rats, and mice are common. The orang-utan and other species of apes are abundant. Among the ruminating quadrupeds are found seven species of deer, the sheep, goat, ox, and buffalo. The single-horned rhinoceros is met with in unusual numbers, and is hunted for its hide and horn, both of which are exported to China. The principal boast of the Siamese, however, is in the high perfection of their elephants, which here attain a size and beauty elsewhere unknown, and are held in high esteem throughout India. Among the birds the water-birds and waders are by far the most numerous; geese, ducks, boobies, cormorants, king-fishers, storks, and pelicans are frequent; the forests abound with peacocks, pheasants, and pigeons; and in the islands are large flocks of the swallows that produce the famed edible birds'-nests. Crocodiles, geckoes, and other kinds of lizards, tortoises, and green-turtles are numerous, the last of which, as well as their eggs, are in great request among the Siamese as an article of food, and from their sale add not inconsiderably to the royal revenue. The python serpent attains an immense size, and there are many species of snakes. The fish of the Menam are abundant.

Trade and Navigation.— Siam has a most extensive trade, both inland and coastwise, as well as foreign. Every province of the kingdom produces some article in foreign demand; and Bangkok, from its situation on the Menam, has become the great centre of all its commerce. The principal articles brought down from the higher provinces are rice and paddy, cotton, teak-timber, rosewood, and sappan-wood, lac, benzoin, ivory, and bees'-wax; while the districts east and west of the Menam furnish gamboge, cardamoms, and sugar; the Malay provinces tin, zinc, cotton, etc. The foreign trade is conducted chiefly with China and more especially with Hong Kong, British India, the United States, and Great Britain. The exports to Europe, carried on partly through Singapore and partly direct, comprise rice, teak, pepper, bullocks, gamboge, tin, cardamoms, ivory, horns and hides, with various minor articles; the imports, all kinds of textile fabrics, iron and steel goods, earthen and glass ware, hardware and cutlery, opium, sugar, etc. The total exports from Bangkok (mainly to Singapore and Hong Kong) were valued in 1900 at $15,000,000, chiefly rice; the imports at $12,000,000. Of British and foreign vessels there entered the port of Bangkok in 1900, 454, of 380,477 tons, of which 169 of 141,856 tons were British. The number of vessels cleared was 450, of 378,073 tons, of which 169, with a tonnage of 142,520, were British. There is a large importation into Bangkok of British goods transshipped at Singapore. Formerly British predominance in the carrying trade of Siam was overwhelming, but other countries, such as Germany and France, have greatly improved their position in recent years. The chief money of Siam is the *tical*, a silver coin the value of which is about 30 cents; the Mexican dollar, value 55 cents, is also common. Only silver and bronze coins are issued.

Arts, Manufactures, etc.— The Siamese have made but little progress in the useful arts. House-carpentry, canoe and junk building, manufacturing pottery and coarse cutlery, leather-dressing, and the construction of musical instruments, are their chief mechanical employments. A few rude hand-looms are in operation, chiefly worked by women, but the fabrics, whether of silk or cotton, are of very coarse quality. Their domestic architecture is in an equally rude and backward state — the houses of the lower orders being formed wholly of wood or bamboo, roofed with palm-leaves, and mostly raised on piles, as in the rest of ultra-Gangetic India. A few only in the capital are built with brick and mortar. Many of their houses, too, are constructed on boats, which abound on the river near Bangkok; of the arch they are wholly ignorant. Roads there are none; and wheel-carriages are all but unknown. On their religious edifices, however, the Siamese bestow abundant labor and expense; these are constructed of solid masonry, and covered with tiles, having all the wood-work laboriously carved and gilded, and filled with carved and richly-gilt images of Buddha.

Inhabitants, Religion, etc.— The Siamese, in common with the Laos, Cambodians, and Malays, are members of the great Mongolian family, and of the same race as the people of Burma and Anam. In stature they do not average more than 5 feet 3 inches in height; they have a lighter colored skin than the western Asiatics, but darker than the Chinese. They are inclined to obesity, have large lower limbs, and stout long arms; yet they are by no means a strong or robust people. Their faces are broad and flat, with round prominent cheek-bones, a small nose obtusely pointed, and rather hollow at the bridge, a large mouth with rather thick lips, the lower jaw long and square at the back, small black eyes, a low forehead, and very scanty beard. Their hair is always black, thick, coarse, and lank, worn close by both sexes, except from the forehead to the crown, where it is about 2 inches long, and made to stand erect. They are temperate and abstemious, by no means revengeful, obedient to the laws, and strongly attached by their domestic ties. Of the population it is estimated that 2,000,000 are Siamese, while the Chinese number 1,000,000, the Malays 1,000,000, and the Laos 2,000,000.

Digitized by Google

The Siamese profess Buddhism of a very degraded kind, introduced into the country about the middle of the 7th century. The moral code of the religion is comprised in five negative precepts — (1) not to kill (which extends to animals, plants, and even seeds); (2) not to steal; (3) to commit no impurity; (4) not to tell falsehoods; (5) to drink no intoxicating liquors. Little attention, however, is paid to any of these, except by the priests.

Language, Literature, and Education.— The Siamese language is exceedingly simple in its construction, and forms a connecting link between the Chinese and Malay. Siamese resembles Chinese in the importance given to tone, the same word having often several very different meanings according to the tone in which it is pronounced. The written characters seem to be derived from a form of Sanskrit. The literature is meagre, uninteresting, and in point of imagination and force of expression much below the Arabic, Persian, or Hindustani; the style is simple and literal, but by no means perspicuous. The Siamese have no histories of a trustworthy character, their works on medicine and law are full of ignorance and confusion, and those on religion and philosophy translations or mere compilations. They have some excellent fables, with very good dramas and other poems. Rhymes are very abundant in Siamese, and their poems are full of rhyming jingles and alliteration. The printing-press has been introduced in recent years, and many of the best Siamese works can now be had in a printed form. Education is carried to a very limited extent; few can do more than read and write awkwardly, and perhaps cast accounts.

Government.— The government of Siam is that of an absolute monarchy. The king is considered almost in the light of a deity, and addressed as such, his most common designations being «Sacred lord of lives,» «Owner of all,» «Most exalted and infallible lord,» etc. The kingdom is hereditary; but the eldest son of the king does not necessarily succeed his father, who may nominate another to be his heir. The executive power is in the hands of the king, who is assisted by a cabinet consisting of the heads of the chief departments of state, and including the ministers of foreign affairs, the interior, justice, finance, war, public instruction, public works, etc. The legislative power is exercised by the king in conjunction with a legislative council consisting of the ministers of state and a certain number of other persons, the duty of the council being to revise, amend, and complete the legislation of the country. The council may appoint committees to deal with various subjects on which legislation is proposed; and it is even entrusted with the power of promulgating laws without the royal assent should the monarch be in any way disabled.

History.— Siam appears to have no place in history prior to 638 A.D., and the credible records go back only to 1350, the date of the foundation of Ayuthia, the old capital, on the Menam, about 60 miles above its mouth. In 1612 an English ship ascended this river as far as Ayuthia, eight years after which the Portuguese sent thither their first missionaries. In 1689 Constantine Phaulcon, an enterprising Greek, became prime-minister, and introduced a respect for European customs and notions. Mutual embassies were at this period sent between Siam and the court of France, with which Phaulcon intrigued to bring about a revolution. This led to his downfall and death, as well as the expulsion of the French. Contests for the throne distracted the country from 1690 till 1759; during which interval Alompra, the victorious ruler of Burma, overran the whole valley of the Menam. The country was afterward wrested from the Burmese by Pye-ya-tak or Phyatak, who was of Chinese extraction, at the head of a number of natives. He planted himself on the throne, and with a view to commerce made Bangkok the metropolis, instead of Ayuthia. Being a cruel ruler he was murdered by his general Chakri, who himself seized the throne in 1782, and was the founder of the present reigning dynasty. Maha Mong-Kut, who ascended the throne in 1851, and died in 1868, was a man of science and energy. He was succeeded by the present sovereign, Chulalongkorn.

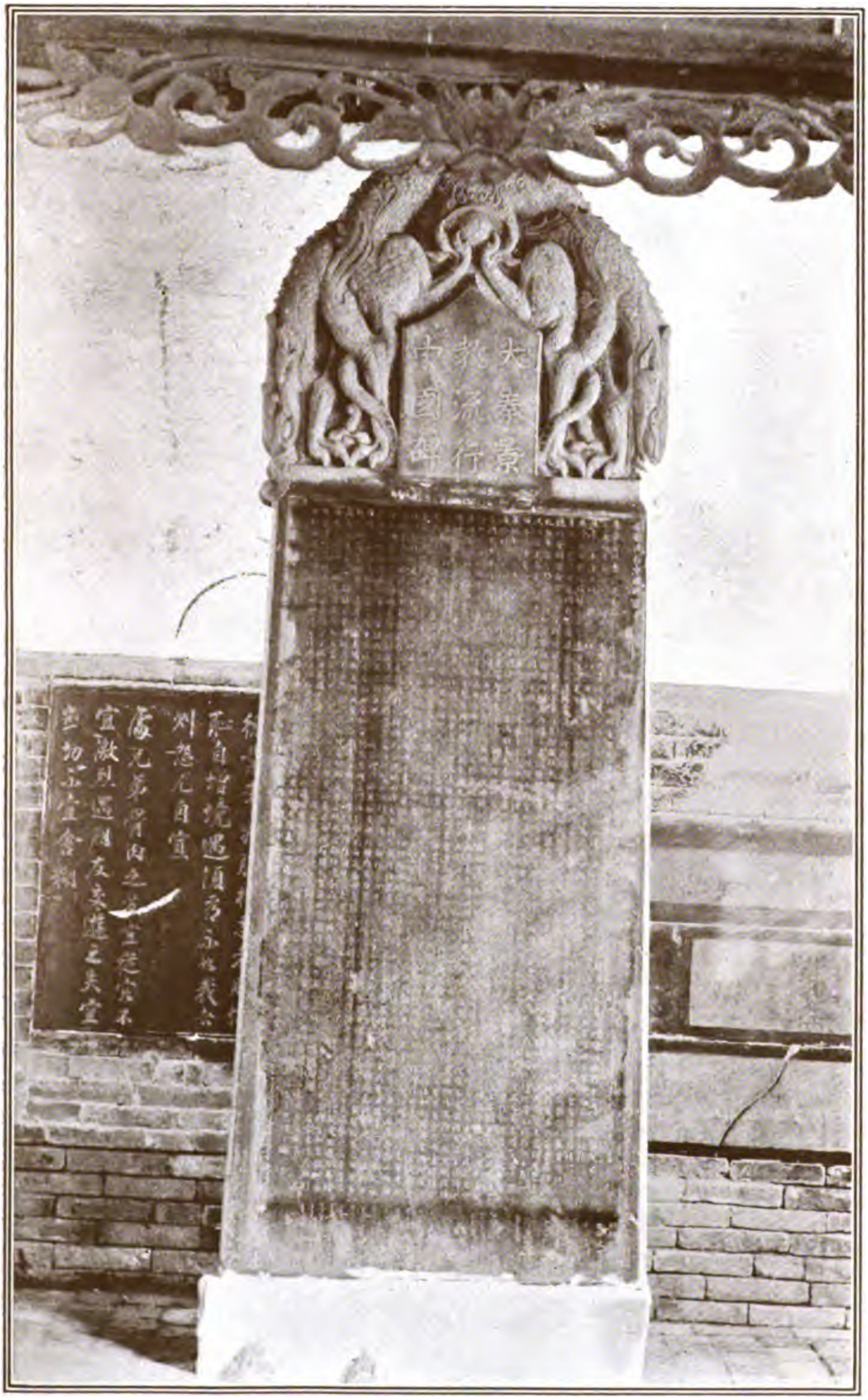
Siam, Gulf of, East India, a large arm of the China Sea, bounded by the Malay Peninsula on the west, and by Siam and French Indo-China on the east. It is about 400 miles long and 250 miles wide, but very shallow, being nowhere more than 300 feet in depth. The large delta of the Mekong is steadily encroaching on its waters.

Si'amang. See GIBBON.

Siamese (sī-ạ-mēs' or mēz') **Twins:** b. Bangesau, Siam, 15 April 1811; d. Mount Airy, N. C., 17 Jan. 1874. The name given to two individuals of Chinese extraction, named Chang and Eng, who from the manner of their physiological connection were regarded as examples of «anterior duplicity.» They grew to be about 5 feet 2 inches in height, could walk, run and swim. In April 1829 they were brought to America and exhibited throughout the United States and later in Europe. They finally settled at Mount Airy, and lived there until their death.

Sian-fu, provincial capital of Shensi, N. W. China, often erroneously called Si-ngan-fu, Sin-gan-fu, Hsian-fu; formerly called Chang-an. Once the important capital of the Tang Dynasty (618,906). Population is probably about 300,000. City became famous through the discovery in 1625 near the western surburban gate of the «Nestorian Monument,» dated 781, a two-ton limestone stela, 10 feet high, with an inscription of more than 2,000 characters in Chinese and Syriac (Estrangelo). The inscription tells of the arrival in 635 of Nestorian missionaries from Syria, who were well received by emperor Taitsung. In 1907 the Danish explorer, Fritz von Holm, set out to try and procure the Tablet for science, but the mandarins at Sian-fu caused the stone to be removed into the Peilin or «Stone Coppice» inside the city walls, where it will be safe and under roof. The Holm-expedition thus preserved the stela for all ages, but it furthermore obtained a perfect limestone replica of the monument, 10 feet high and weighing two tons, which was brought to New York, where it was placed as a loan in the Metropolitan Museum of Art. «Ching-chiaopi» is the Chinese name of the Tablet. Sian-fu was again the capital of China for nine months, in 1900-01, when their late Majesties the emperor and empress-dowager fled thither from Peking during the Boxer troubles.

Digitized by Google



Photograph presented by Dr. Frits von Holm.

THE ORIGINAL NESTORIAN MONUMENT OF A.D. 781.

The picture represents the monument as it now stands, protected and under roof as a result of THE HOLM-NESTORIAN EXPEDITION TO SIAN-FU, 1907-1908, in the "Peilin" ("stone coppice") of Sian-fu near the south gate. The priceless monument was practically exposed to wind and weather from A.D. 1625, when it was found, till 1907, when the Danish explorer, Dr. Frits v. Holm, M.R.A.S., visited it and had a limestone replica made. The tablet is 10 feet high and weighs two tons. The replica is in the Metropolitan Museum of Art in New York City.

Digitized by Google

Digitized by Google

Siargao, sē-är-gä'ō, an island of the Philippines, 20 miles from the northeast coast of Mindanao; length 20 miles, north and south; width, 14 miles; area, 176 square miles. It is traversed from north to south by a mountain range, the highest peaks of which are in the south. The northern, southern, and western coasts are paralleled by a reef lying three miles off shore; the ports on the coast are reached by natural channels through this reef. The island has seven towns, several hamlets, and a considerable rural population.

Sibalón, sē-bā-lôn', Philippines, pueblo, province of Antique, island of Panay, on the Sibalon River, 6 miles from its mouth, 10 miles northeast of San José de Buenavista. Pop. 11,680.

Sibbald's or **Blue Whale.** See WHALE.

Siberia, sī-bē'rĭ-a, and **Asiatic Russia,** the large section of the Russian Empire (see RUSSIA), east of the Ural Mountains and Caspian Sea, occupying the whole of northern Asia above lat. 50° N., and between lon. 60° and 190° E., and in the southwest, extending so far south as the parallel of 40°. It is bounded north by the Arctic Ocean, east by the Sea of Kamchatka and the North Pacific Ocean, south by the Sea of Okhotsk, the Chinese territories, Tibet, Afghanistan, and Persia, and west by Russia in Europe; greatest length, from west to east, about 3,600 miles; greatest breadth, about 2,200 miles. The total area of Siberia proper, including the island of Sakhalin, in the north Pacific, ceded by Japan in 1876, is 4,833,496 square miles; pop. (1897) 5,727,090. Since the extension of the Russian dominions in central Asia a territorial division called Central Asia has been formed, partly taken from what was formerly Siberia, partly formed of newly-acquired territory, and comprising the geographical regions sub-divided into provinces, of Northern Caucasia, and Trans-Caucasia, forming the Caucasus, area, 180,843 square miles; pop. 9,248,695; the Steppes, area, 755,793 square miles; pop. 2,461,278; Turkestan, 409,434 square miles; pop. 4,888,183; Trans-Caspian, 214,237 square miles; pop. 372,193; giving with the Caspian Sea, area, 169,381 square miles, a total area for Asiatic Russia of 6,564,778 square miles, pop. (1897) 22,697,469. Siberia, strictly so-called, is therefore of smaller extent than formerly. The administrative divisions of the whole territory, with their separate population, are exhibited in the table given under Russia (q.v.). The chief towns of Siberia are Irkutsk, capital of eastern Siberia, a trading city; Tomsk, capital of Tomsk province, a trading city, with a university; Tobolsk, capital of western Siberia, Omsk, Krasnoiarsk, and Yakutsk. The principal ports are Vladivostock, on the Sea of Japan, the chief naval station of Russia on the Pacific; Okhotsk, on the Sea of Okhotsk; and Petropavlovsk, on the east coast of Kamchatka. Other important towns of Asiatic Russia are Tiflis, Fashkend, Baku, etc.

The leasing of the Liao-tung Peninsula with Port Arthur and Dalny (qq.v.) from the Chinese in 1898, and the protectorate established over Manchuria, consequent on the Boxer troubles of 1901, embroiled Russia in war with Japan in 1904, retarding the colonization of Manchuria which was rapidly proceeding to a probable annexation. See MANCHURIA.

Topography.— The coast line is very extensive, but the Arctic Ocean is ice-bound at least 10 months out of the 12 and is almost valueless for commercial purposes, while the Sea of Okhotsk, on the Pacific, is infested with masses of floating ice and dense fogs during several months of the year. Asiatic Russia in the extreme southwest is partly below the level of the ocean, and is drained either into the Caspian, or by the Amu Daria and Sir Daria into the Aral. A large part of this region is desert, and the soil is frequently impregnated with salt. The remainder of the Russian territory, though comprising the whole of northern Asia from west to east, has much less diversity of surface than might be presumed from its extent. Assuming the meridian of 105° as a line of demarcation, two regions will be formed — a western and an eastern, exhibiting a very marked difference in the configuration of their surface. Both regions have their greatest altitude in the south, and may be considered as a vast inclined plane, sloping gradually north to the Arctic Ocean; but the eastern region is traversed in different directions by several mountain-regions, whereas the western region, with the exception of the chain of the Ural on the western, and that of the Altaï on the southern frontiers, forms a vast plain, almost unbroken by any greater heights than a few hills and the banks of the rivers which wind across it. This plain, toward the south, has a height of about 2,000 feet above the sea, but toward the north is so near its level as often to become extensively inundated. For convenience of description it has been arranged, according to its productive powers, in four divisions — the steppe or pastoral, the agricultural, the woody, and the moorland or tundra. The steppe, occupying the most elevated part of the plain, extends from the southern frontiers north to lat. 55°; and from the western frontiers, within these limits, east to the banks of the Irtish. The greater part of it consists of what is called the Steppe of Ishim, and has a bare and almost sterile surface, often incrusted with salt, but also occasionally covered with a scanty vegetation. The agricultural division extends northward to about lat. 60°. In many parts, where it borders on the steppe, it has much of the same character, and has only occasional tracts which have been or can be advantageously brought under the plow; and in many other parts primeval forests are often found. The division thus named, an extent more than double that of the British Islands, under favorable circumstances might furnish subsistence to a very large population; but as yet it is only the more fertile alluvial tracts adjacent to the rivers that have been brought under anything like regular culture. Within this division, though not properly belonging to it, is the Steppe of Baraba, situated between the Irtish and the Obi. It has a more abundant vegetation than the Steppe of Ishim, which it otherwise resembles, and in its northern portion is covered with nearly continuous forests of birch and fir, haunted by numerous wild animals, including the beaver. From this the wooded division extends northward to lat. 64°, and in parts to 66°, though in the higher latitude the trees are seldom of very vigorous growth. The whole of this division is covered with vast forests of birch and different species of fir and pine. The population, few in numbers, are set-

Digitized by Google

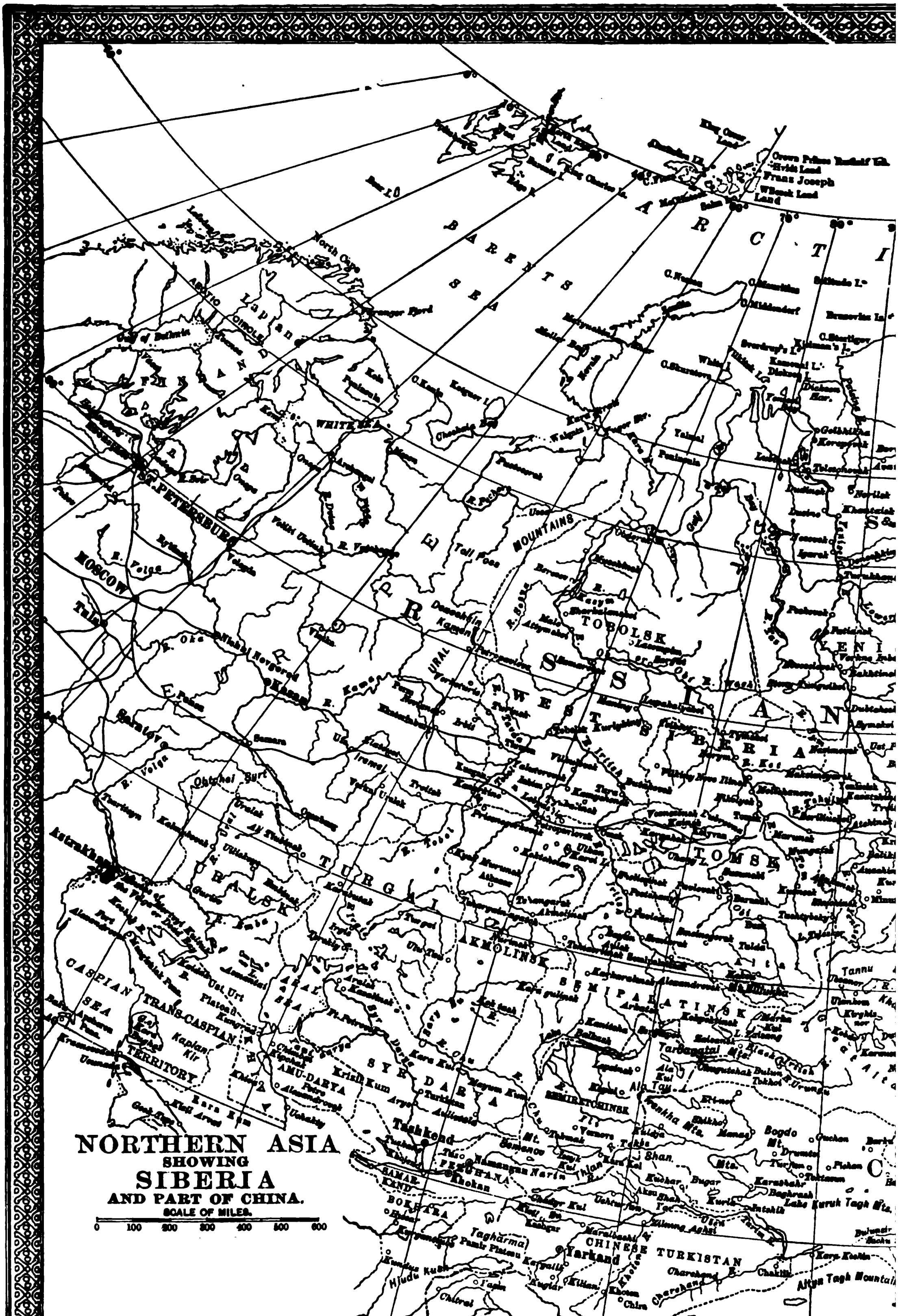
tled chiefly on the banks of the Obi and Yenisei, and live mainly on game and fish; the latter, including salmon, sturgeon, and herrings, ascending from the sea as far as the confluence of the Tom. Wild animals also are very numerous, and many valuable furs are obtained. The last division is that of the moorland or tundra, consisting of a low monotonous flat covered with moss, and nearly destitute of trees. It extends along the shores of the Arctic Ocean, and has so rigorous a climate that even in summer ice is found a few inches below the surface. Here the reindeer exists in vast herds, both wild and domesticated; white bears and foxes are also numerous, and furnish valuable furs; and the coasts and mouths of the rivers are frequented by immense shoals of fish and flocks of fowl.

Siberia to the east of lon. 105°, forming nearly one half of the whole territory, has a much more diversified surface than the western region, and owing partly to its general ruggedness and elevation, and partly to the greater severity of its climate, has much less land adapted for agricultural purposes. The Sea of Okhotsk has a bold and rocky shore, and the country behind rises with a steep ascent till a mountain-range is formed, with a general altitude of nearly 3,000 feet above sea-level. This range, under the name of the Stanovoi Mountains, runs nearly parallel with the coast till it reaches the frontiers of China, where it takes the name of the Jablonnoi Mountains, and proceeding west continues for a long distance to form the boundary between the two empires. It then takes the name of the Mountains of Daouria, and throws out numerous ramifications, which, continuing west, throw their arms round Lake Baikal, and cover almost all the south part of the government of Irkutsk. Other ramifications, proceeding north, form the water-sheds of the numerous affluents of the right bank of the Lena. On both sides of this river the surface continues elevated, and forms a table-land, the interior of which is still very imperfectly known. The best portions of eastern Siberia occur in the south of the government of Irkutsk, where, in the lower and more open valleys in the vicinity of Lake Baikal, cultivation has been attempted with success, and the oak and hazel, unknown in other parts of Siberia, are found growing freely. In almost the whole of the same government, where the configuration of the surface does not present invincible obstacles, all the grains of Europe are grown, and even the mountains and hills are covered during the greater part of the year with good pasture. Still farther north, in the government of Yakutsk, as far as the town of same name, corn is cultivated in patches in the upper vale of the Lena, though the far greater part of it is covered with fir and pine. The north part of eastern Siberia consists of two distinct portions, the one extending from lon. 105° E. to the lower valley of the Lena, and the other from that valley east to Bering Sea. The former portion is imperfectly known; the latter, as far as the Kolyma, is traversed from north to south by chains of low hills, separated from each other by wide valleys or open plains, and generally overgrown with stunted larch and birch. In these valleys and plains are numerous lakes, generally well supplied with fish, and bordered by low banks, on which a rich grassy sward is often seen. To the east of the Kolyma branches from the Stanovoi Mountains stretch north, and form a series of ranges which frequently rise from 2,000 feet to 3,000 feet. Some of these penetrate to the north coast, and are seen forming precipitous cliffs at Shelagskoi Nos, Cape North, and other headlands. Other ramifications from the Stanovoi pursue an opposite course, and traverse the remarkable peninsula of Kamchatka almost centrally to its southern extremity.

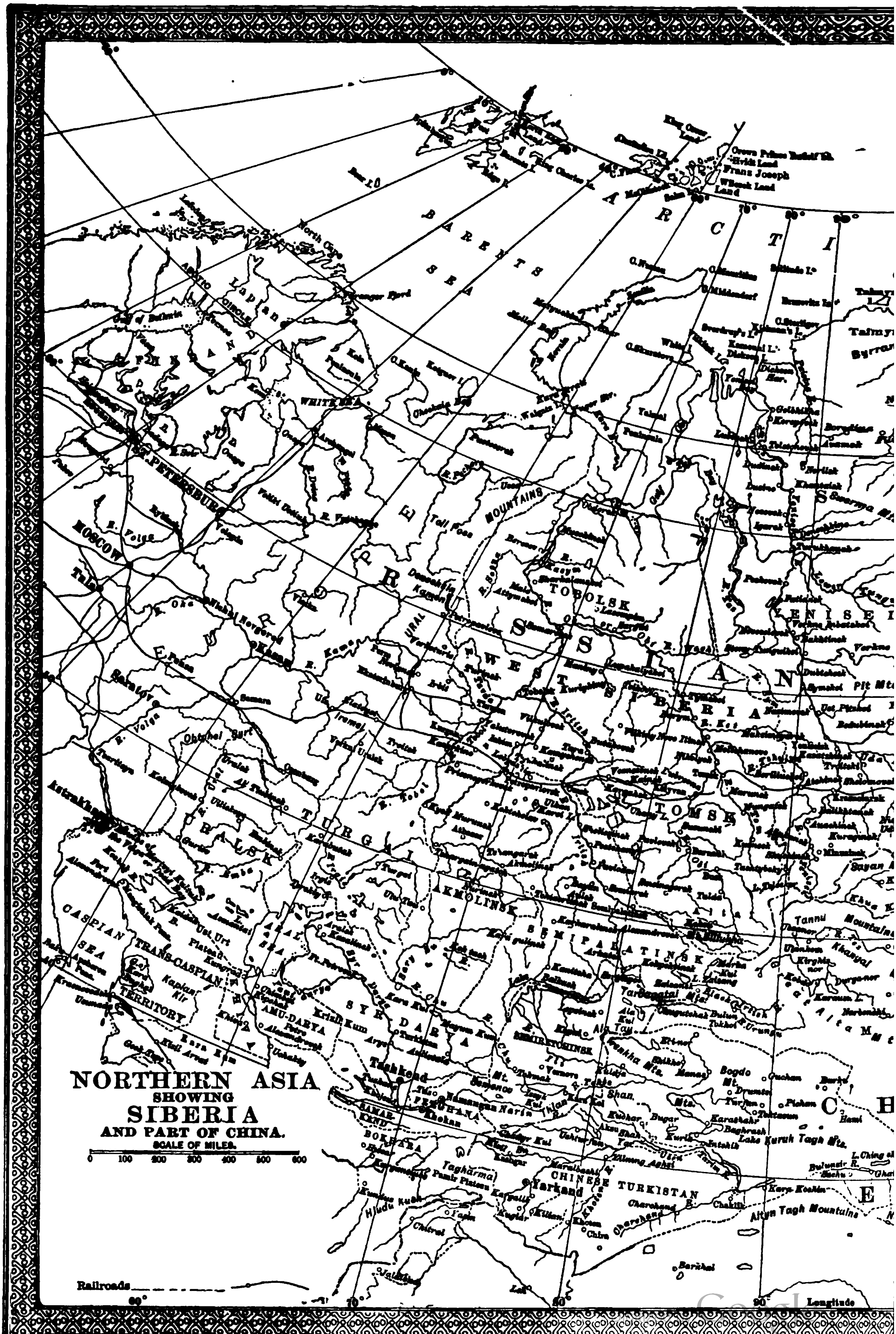
Hydrography.— The rivers are numerous and of great magnitude. From the configuration of the country they almost all flow in a northerly direction, and belong to the basin of the Arctic Ocean. The chief exceptions are the Anadir and the affluents of the Amur in the east, and the Sir Daria, Amu Daria, and other streams in the southwest. The great rivers belonging to the basin of the Arctic Ocean flow for the most part through immense tracts of level country, and hence are remarkable at once for the length of their course, the volume of water which they accumulate from numerous and important affluents, and the few obstacles which they present to a continuous navigation. The advantages which they offer in the latter respect are diminished by the long period during which they are frozen over; but even then they do not cease to be available for traffic, and become, in fact, the great highways of the country. The Obi is one of the largest rivers of the Old World; the length of its course is 2,400 miles, and the area of its basin is 1,224,435 square miles. Among its important affluents, many of them so large as to be entitled to rank as magnificent rivers, are the Irtish, Ishim, and Tobol, which, by uniting their streams, more than double its volume; the Tom, Tchulin, and Ket. The estuary of the Obi forms a gulf from 70 miles to 80 miles wide, and about 400 miles long. Large quantities of fish are taken in this river and its tributaries. The Yenisei, the second river in importance, draws its waters from an area of not less than 1,020,000 square miles. The length of its course, if measured from the commencement of the Selenga, its remotest tributary, exceeds that of the Obi by 100 miles. Its most important affluents are the Selenga, which, before entering Lake Baikal, drains an area of more than 140,000 square miles; the Angara, which receives the discharge of the lake, and in the lower part of its course takes the name of Upper Tunguska; the Middle Tunguska, and the Lower Tunguska. The estuary of the Yenisei is about 20 miles wide, and 200 miles long. The Lena has a course of about 2,000 miles, and drains an area of about 800,000 square miles. It rises hardly 20 miles to the west of Lake Baikal, and becomes navigable at 50 miles from its source. Its principal affluents are the Vitim, which has a course of 700 miles, of which a considerable part is navigable; the Olekma, which flows 500 miles through interminable forests; the Aldan, which drains an extensive tract of table-land between lon. 125° and 140° E.; and the Viliui, which rises in a mountainous district not far from the Lower Tunguska, and flows west for about 600 miles. The most important of the minor rivers which send their waters directly to the Arctic Ocean are the Olenek, between the Yenisei and Lena; and to the east of the latter, the Indighirka and Kolyma. The only important lakes are those of

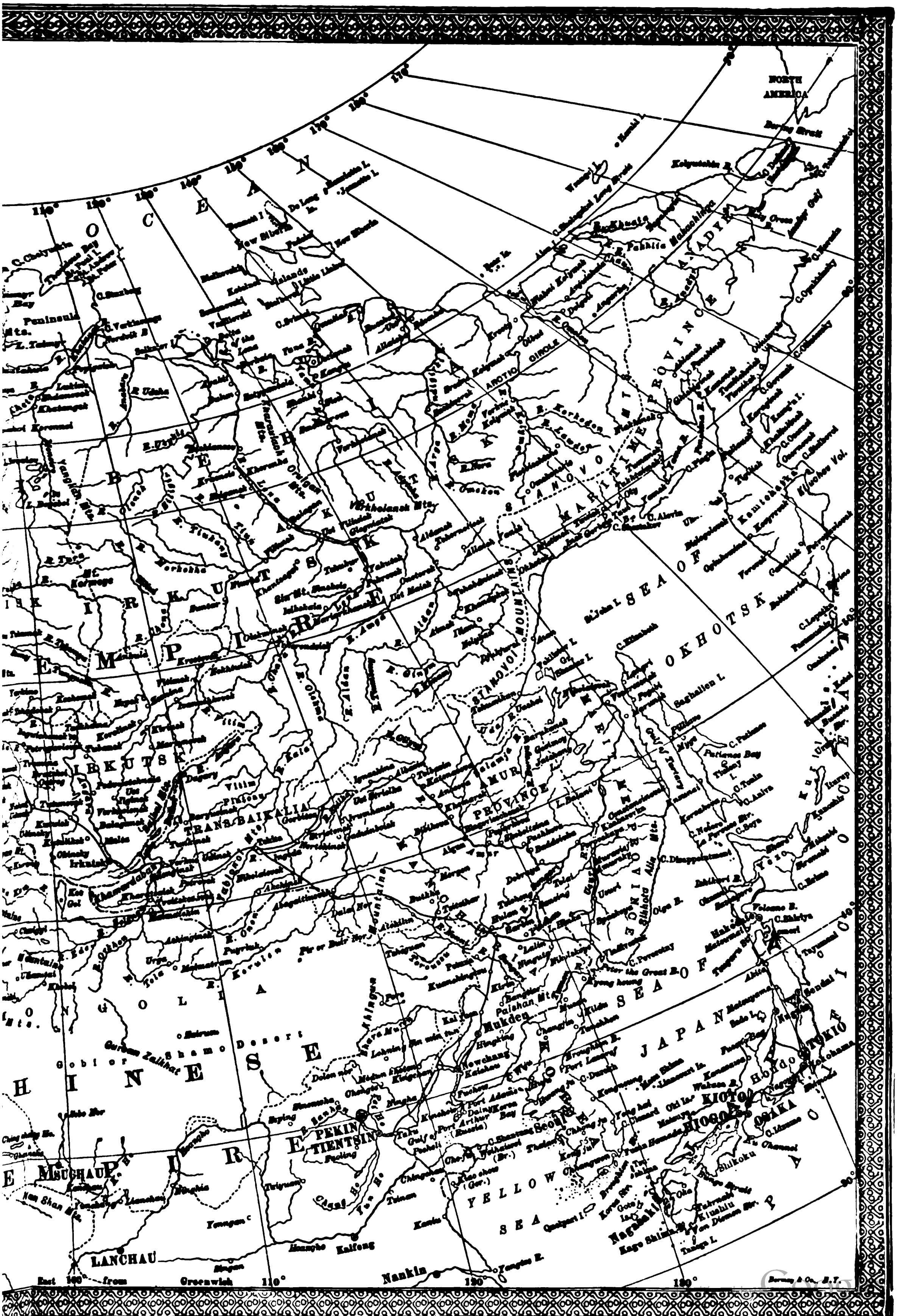
Digitized by Google

Digitized by Google


NORTHERN ASIA
SHOWING
SIBERIA
AND PART OF CHINA.
SCALE OF MILES.
0 100 200 300 400 500 600
Railroads
BARENTS SEA
ARCTIC
Franz Joseph Land
WHITE SEA
FINLAND
ST. PETERSBURG
MOSCOW
URAL
MOUNTAINS
TOBOLSK
WEST SIBERIA
TOMSK
TURGAI
URALSK
AKMOLINSK
SEMIPALATINSK
CASPIAN SEA
TRANS-CASPIAN TERRITORY
ARAL SEA
SYR DARYA
AMU-DARYA
SEMIRETCHINSK
Tashkend
FERGHANA
SAMARKAND
BOKHARA
CHINESE TURKISTAN
Yarkand
Astrakhan
Saratov
Kazan
Samara
Tarbagatai Mts.
Altai
Tian Shan
Kuruk Tagh Mts.
Altyn Tagh Mountains
60°
70°
80°
90°
Longitude

Digitized by Google


NORTHERN ASIA
SHOWING
SIBERIA
AND PART OF CHINA.
SCALE OF MILES.
0
100
200
300
400
500
600
Railroads
Longitude
BARENTS SEA
ARCTIC
ARCTIC CIRCLE
Franz Joseph Land
North Cape
Lapland
FINLAND
WHITE SEA
ST. PETERSBURG
MOSCOW
EUROPEAN RUSSIA
URAL MOUNTAINS
TOBOLSK
WEST SIBERIA
ASIAN
TOMSK
YENISEI
TURGAI
URALSK
AKMOLINSK
SEMIPALATINSK
CASPIAN SEA
TRANS-CASPIAN TERRITORY
ARAL SEA
SYR DARYA
SEMIRYETCHINSK
FERGHANA
BOKHARA
CHINESE TURKISTAN
Yarkand
Tashkend
Astrakhan
Saratov
Samara
Kazan
Tula
Orenburg
Tannu Mountains
Altyn Tagh Mountains
Pamir Plateau
Tian Shan



NORTH AMERICA
Bering Strait
O C E A N
New Siberia
De Long Is.
ARCTIC CIRCLE
Verkhoyansk Mts.
Yakutsk
STANOVOI MOUNTAINS
MARITIME PROVINCE
SEA OF OKHOTSK
Saghalien I.
Patience Bay
IRKUTSK
Irkutsk
TRANS-BAIKALIA
AMUR PROVINCE
Amur
Peter the Great B.
SEA OF JAPAN
Hakodate
TOKIO
Yokohama
KIOTO
HIOGO
OSAKA
Shikoku
Kiushiu
Nagasaki
Kago Shima
Van Dieman Str.
Seoul
YELLOW SEA
Mukden
Newchang
Port Arthur
Gulf of Port Arthur
PEKIN
TIENTSIN
Gobi or Shamo Desert
M O N G O L I A
C H I N E S E   E M P I R E
Nan Shan Mts.
LANCHAU
Kaifong
Nankin
East 100° from Greenwich 110° 120° 130°

Digitized by Google

Baikal in the government of Irkutsk, the Sea of Aral, and Balkash-Nor or Tenghiz, in the southwest. Numerous other lakes are scattered over the surface, and more especially in the tundras, where whole chains of them, covering extensive tracts, not unfrequently occur.

Geology and Minerals.— Granite and crystalline schists are found chiefly on the eastern slopes of the Ural Mountains, in the south among the mountain-ranges of the Altaï as far north as lat. 57° N., and between lon. 85° and 120° E., chiefly in the governments of Tomsk and Irkutsk, on both sides of the Upper Tunguska and east of the Yenisei; in the upper part of the basin of the Middle Tunguska; and in the very eastern extremity of the country, from lon. 165° to the shores of Bering Strait. The volcanic rocks belong mostly to the Tertiary period, and are found chiefly in the south, in connection with the granite and crystalline schists above described. They compose the great mass of the mountain-range which skirts the western shores of Lake Baikal, and are seen in a still more magnificent and interesting form in the mountains which proceed from north to south, nearly through the centre of the Peninsula of Kamchatka, where are several active volcanoes. Palæozoic rocks, including the rocks belonging partly to the Silurian, partly to the Devonian, and partly to the Carboniferous systems, are developed chiefly in the south, where they occupy a large space in the form of a triangle, the apex of which is at the town of Irkutsk, and the base on the parallel of 60°, between lon. 85° and 120° E. Another large development of the same rocks is seen on the northwest and north of the Sea of Okhotsk, and to a considerable distance inland. Secondary rocks higher in the series than the Carboniferous system commence near the northern shores of Lake Tenghiz, and stretch northward, occupying a considerable tract on both sides of the upper valley of the Irtish; a more partial development of the same rocks is seen on the north of the Obi, commencing near the confluence of the Ket, and extending north in a comparatively narrow belt to the sources of the Taz. The most extensive formation in Siberia is the Tertiary, which stretches almost continuously from the last slopes of the Ural Mountains east across the Obi to the valley of the Yenisei; and in other quarters, though more intermingled with earlier formations, covers no inconsiderable portion of the whole surface. The shores of the Arctic Ocean, almost throughout their whole extent, and to a considerable distance inland, have a deep alluvial covering, remarkable for containing deposits of fossil elephants and other animals in such quantities that the ivory obtained from them forms an important article of commerce. The minerals of Siberia are evidently of immense value, and though the real extent of surface on which they are found is as yet only roughly guessed at, there cannot be a doubt that the most precious of all the metals exists there in greater abundance than in any other part of the Old World. Till recently the auriferous deposits were supposed to be almost confined to the eastern slopes of the Ural Mountains, and to occupy a zone extending over from 5° to 6° of latitude to the north and south of Ekaterinburg; but it has been discovered that some of the eastern regions, particularly in the governments of Tomsk and Yeniseisk, are highly auriferous, and that a tract larger in area than the whole of France contains gold, not in its alluvia, but in the very matrix of its rocks of palæozoic schists and limestones, which, when pounded and analyzed, are found to be more or less impregnated with gold. The principal mining districts are those of the Ural already mentioned, the Altaï, and Nertchinsk, in the basin of the Amur. Besides gold, iron, copper, silver, platinum, lead, tin, and zinc are found in greater or less abundance. The other notable minerals of Siberia are the emerald and topaz, of which there are celebrated mines at Nertchinsk; salt, found in natural crystals on the banks of lakes, chiefly in the steppes of Ishim and Baraba; jasper and porphyry of great beauty, quarried especially in the valley of the Charysh among the Altaï Mountains; lapis-lazuli, found among the mountains in the vicinity of Lake Baikal; diamonds, found occasionally on the eastern slopes of the Ural Mountains; malachite, obtained in greater or less quantity from all the mining districts, containing copper; and mica, in the form of large plates, extensively used as a substitute for glass, and found in greatest abundance on the banks of the Vitim.

Climate.— This country is remarkable for its rigor. The isothermal line which skirts the southern coast of Iceland, in proceeding east, descends rapidly till it reaches Saint Petersburg, and then more gradually till it reaches lon. 100° E., where it is found in lat. 52°. From this it proceeds nearly due east, passing through the southern part of Lake Baikal, the town of Nertchinsk, and the southern extremity of Kamchatka. It thus appears that the southern coast of Iceland, in lat. 63°, has the same mean temperature as eastern Siberia in lat. 52°; in other words, that in proceeding from west to east the cold increases so much as to make places in the same latitude as Berlin to have a climate nearly as cold as Iceland. In the same manner the line of permanent ground-frost descends in parts of Siberia as far south as lat. 56°, nearly the same as that of Edinburgh; and over the whole country to the east of the Ural Mountains is as low as lat. 60°. Erman found that annually between 17 December and 18 February, and most frequently in the first three weeks of January, cold is experienced exceeding 90° F. below the freezing-point; and that for two entire months, or one sixth part of the whole year, mercury is a solid body. This extreme winter is succeeded by an exceedingly warm summer. Thaw usually commences on the 1st of April, and the temperature increases rapidly till it attains its maximum in July. In this month the average height of the thermometer is about 66° F., but it not unfrequently rises in the shade above 77°. In Yakutsk, where the cold is severest, notwithstanding its long and extreme winter, there are 128 days in the year without frost; and within that period several kinds of grain, not excluding wheat, have time to attain maturity; and in rich alluvial soils often produce a return of fifteen-fold.

Manufactures and Commerce.— The manufactures are limited, and are confined for the most part to a few of the larger towns, where government factories have been established. The more important articles are leather, earthenware, porcelain, glass, and hardware. In some places, as at Telma, large woolen and linen factories

Digitized by Google

employ a considerable number of hands, chiefly exiles, in weaving woolen and linen cloth, and in conducting all the previous processes of preparing the wool, flax, etc. The trade is of considerable extent; and in so far as confined to the produce of the country consists chiefly of cattle, fish, caviar, furs, skins, and metals. A very important transit trade is also carried on across the country between Russia in Europe and China. From the latter part by far the most important article is tea, both in the dried leaf and in the form of cakes or bricks. The greater part of the latter is disposed of to the nomadic tribes, and a very large proportion of the former never passes beyond the limits of Siberia, but is retained for home consumption. Other articles of importance from China are coarse cotton stuffs, rhubarb, silks, satins, etc. The chief mart for this trade is the town of Kiachta, and extensive fairs are held at various places. For the interior traffic the rivers naturally furnish the most important conveyance; but when these become closed with ice other means of conveyance must be resorted to, among which the most characteristic is that of sledges drawn by reindeer or dogs. Great impetus has been given to commerce and colonization generally throughout the region, by the completion of the railway, the longest in the world, connecting the far Orient with Europe. (See TRANS-SIBERIAN RAILWAY.) The length of railways throughout Asiatic Russia in 1903 was 9,026 miles. A trade by sea has also been opened up between Europe and the rivers Obi and Yenisei.

Ethnology.— The races and tribes scattered over the different parts of Siberia are so numerous that little more can be done here than to give the names of the more important. At least two thirds of the whole population is Russian, and consists either of voluntary emigrants, who have found it their interest to settle in the country, or of exiles and their descendants. In regard to the exiles Siberia is merely a penal settlement, and hence that portion of the population which, as coming from Europe, ought to be the most civilized, is not likely to be the most exemplary. A more unsophisticated, and far more interesting, population is furnished by the indigenous tribes. Beginning at the Ural Mountains and proceeding eastward we find the Samoyedes in the northwest. Immediately south of these the Ostiaks occupy both sides of the Obi, up to the confluence of the Irtish, the northern part of the steppe of Baraba, and the whole of the woody region eastward to the banks of the Yenisei. They live by fishing and hunting, and though their physical structure is by no means robust they display both great dexterity and courage in attacking the larger and fiercer animals, both of the land and water. Some of them have embraced Christianity, but the great majority continue addicted to Shamanism. In the south, among the Altaï Mountains, the Kalmucks predominate, but have laid aside a number of the usual peculiarities of their race. They subsist chiefly on the produce of their horses, cattle, and sheep, and cultivate a little grain and tobacco. They have some skill in mechanical arts, particularly in the working of iron, and make their own gunpowder. Though not Buddhists they are generally addicted to other forms of superstition. Among the eastern slopes of the Altaï are several Turkish tribes. The Buriats dwell chiefly on both sides of Lake Baikal, and eastward as far as the Onon. They are of Mongol origin, and closely allied to the natives of the northern provinces of China both in language and customs. The Tunguzes or Toongooses are the most widely dispersed of all the native tribes, being found throughout many parts of Siberia from the Arctic shores to the frontiers of China. They are considered the best-formed of the native Siberians, are very expert horsemen, and live chiefly by hunting. The Yakuts live intermingled with the Tunguzes, and confine themselves almost entirely to the rearing of horses and cattle, and the preparation of dairy produce from them. They are of Tartar origin, and not a few of them are nominal converts to Christianity, though the majority, like the Tunguzes, still adhere to Shamanism. The Tchuktches occupy the northeastern portion of Siberia, and their language proves them to have a common origin with the Esquimos. Some of them spend their time in hunting and fishing, while others are nomadic in their habits. Interesting and valuable information on these tribes was collected by the Morris K. Jesup Expedition which returned to the United States in 1904.

History.—Siberia appears to have been partly conquered by Genghis-Khan and his successors, but did not become known to Europe till 1580, when a Cossack called Yermak Timofeyew, who had long robbed the vessels which navigated the Volga, finding himself hotly pressed by the Czar of Moscow, crossed over into Asia with his accomplices. Their number sufficed to form a small army, and their courage soon enabled them to acquire extensive settlements. These Yermak offered to the czar on the condition of obtaining pardon. The offer was accepted, and thus Russia for the first time obtained a footing in Asia. The territories thus conquered belonged to the Tartar prince Kutshum-Khan, and included his residence, which, called by the natives Isker, and by the Cossacks Sibir, has given name to the whole country. The conquests of Yermak were gradually extended, till the whole country west of the Obi was subjected to the czar. In 1604 the town of Tomsk was founded, and became a centre from which new expeditions were fitted out and new conquests made. Private adventurers, instigated chiefly by the hope of plunder, proceeded in all directions to the south, where, not without serious reverses, they succeeded in expelling the Kirghiz; and to the east, where they entered the basin of the Lena, subdued the Yakuts, and finally, after passing the Aldan Mountains, reached the Sea of Okhotsk. In the neighborhood of Lake Baikal a formidable resistance was made by the Buriats, but their subjugation was finally completed in 1658. The town of Nertchinsk, which has since become so celebrated for its mines, was then founded, and, two years after, that of Irkutsk. A further extension of conquests to the south brought the adventurers into collision with the Chinese, and both governments taking part in the quarrel, a war, threatening the existence of one or other of the empires, became imminent. It was, however, prevented, partly by the intervention of the Jesuits resident at Peking, and a treaty in 1689 definitely fixed the boundaries of the two empires. A second treaty in 1727, confirming the former, regulated the commercial intercourse,

Digitized by Google

and confined it to the two localities of Kiachta and Maimachen. Never has so large a territory been acquired at so little expense. Russia, almost without any expenditure of her own means, and chiefly by the aid of a few Cossack adventurers, in little more than a century more than doubled her area. The greater part of it indeed is a frozen inhospitable region, which must always remain comparatively worthless; but vast tracts possess a climate and soil well adapted for agriculture, and seem destined to become the abodes of a dense population engaged in agriculture, mines and fisheries. The Russian dominions were extended by the acquisition of the Amur territory and coast regions of Manchuria ceded by China in 1858 and 1860, and by later acquisitions already detailed under RUSSIA.

Bibliography.— Aulagnon, 'La Sibérie Economique (1901); Cobbold, 'Innermost Asia' (1900); Dolgorukoff, 'Guide over Siberia' (annual); Fraser, 'The Real Siberia' (1902); Hedin, 'Through Asia' (1898); Jefferson, 'Roughing it in Siberia' (1897); Krausse, 'Russia in Asia' (1899); Lansdell, 'Russian Central Asia' (1885); Skrine and Ross, 'The Heart of Asia' (1899); Stadling, 'Through Siberia' (1901).

Siberian Railway. See TRANS-SIBERIAN RAILWAY.

Sibley, sĭb'lĭ, **Henry Hastings,** American soldier: b. Detroit, Mich., 20 Feb. 1811; d. Saint Paul, Minn., 18 Feb. 1891. He was chosen delegate to Congress from Wisconsin and Minnesota Territories in 1849, representing both in a similar capacity until 1853. He was elected the first governor of Minnesota 1858, and through his personal efforts he successfully brought the Sioux war to a close 1863. The later years of his life were occupied with the general educational interests of his State.

Sibley, Henry Hopkins, American general: b. Natchitoches, La., 25 May 1816; d. Fredericksburg, Va., 23 Aug. 1886. He was graduated from the United States Military Academy in 1838, served in the Florida and Mexican wars, and at the outbreak of the Civil War entered the Confederate service and reached the rank of brigadier-general. At the close of the war he went into the service of the Khedive of Egypt where he held the commission of brigadier-general.

Sibley, Hiram, American financier: b. North Adams, Mass., 6 Feb. 1807; d. Rochester, N. Y., 12 July 1888. In his early life he worked as shoemaker, and later as journeyman machinist in a cotton-factory. In 1843 he established a banking business at Rochester and later was elected sheriff of Monroe County. He was interested in the early experiments in electric telegraph and aided in securing an appropriation from Congress to further the inventions of Samuel F. B. Morse. He combined with other capitalists, among whom was Ezra Cornell, and consolidated the small existing telegraph companies into the Western Union, which was chartered by the legislatures of New York and Wisconsin in 1856. He was elected president of the company and held the office for ten years. In 1861, he began the construction of a transcontinental railway that was afterward incorporated with the Eastern systems, making a continuous line from the Atlantic to the Pacific. He projected a telegraphic line with Europe by way of Bering Strait and Siberia and to this end obtained valuable franchises from Russia, but the project was abandoned when the success of the submarine telegraph was assured. After retiring from the telegraph business he engaged in railroading, mining operations and various other industries. He owned large tracts of improved land and was interested in a seed and nursery business at Rochester. He founded the Sibley College of Mechanical Arts at Cornell University and presented Sibley Hall to the University of Rochester.

Sibley College, a department of Cornell University. See CORNELL UNIVERSITY.

Siboney, sē-bō-nā'ē, Cuba, a village 10 miles southeast of Santiago de Cuba, near which the United States troops disembarked in the Spanish-American War. It was the scene of a sharp struggle between the American and Spanish forces 23 June 1898. Four troops of Rough Riders, under Colonels Wood and Roosevelt, were ambushed at this point and 16 Americans were killed. Notwithstanding their surprise and losses the Americans charged up the hill with such intrepidity that the Spaniards abandoned their block-house and fortified position, leaving 40 of their dead behind. The village was found to be infested with yellow fever, and in July was burned to the ground at the request of the medical officers.

Sibonga, sē-bōng'ā, Philippines, pueblo, province of Cebú, on the east coast, 28 miles west of Cebú, the provincial capital. It is on the coast highway, has a good anchorage, and is open to coastwise trade. Pop. 23,455.

Sibutu, sē-boo'too, an island of the Tawi Tawi group, Sulu Archipelago, Philippines, 30 miles southwest of the island of Tawi Tawi; 18 miles long, two miles wide; area 36 square miles. The surface is mostly flat, with a conical hill in the centre rising to the height of 500 feet. It is heavily wooded, and the soil is fertile, but there is no agriculture; there is a transient population of Moro and Sulu fishermen and a small village on the southeast coast. This island was found to be nine miles outside the western line of demarcation under the Paris treaty with Spain, and in 1900 was brought (with Cagayan) by the United States for $100,000.

Sibuyan, sē-boo-yān', an island of the Romblón group, Philippines, the second largest and most eastern island of the group, 50 miles north of Panay; area 90 square miles. It is very mountainous, the highest peak being Mount Sibuyan (6,424 feet); there are three principal rivers, and a number of smaller rivers and streams which furnish excellent drinking water. The island is heavily wooded, and the soil very fertile, but the inhabitants lack thrift and industry, and no attempt is made to develop their natural resources. Some rice, vegetables, and an inferior quality of tobacco are raised, for home use only. Gold is found in the sands of the Nailog River, and a number of the inhabitants are engaged in placer mining; trepang and tortoise shells are gathered on the coast. Pop. 18,000.

Sibyl, sib'ĭl, and **Sib'ylline Books.** Certain women supposed to be inspired by a deity were

Digitized by Google

called Sibyls by the Greeks. Regarding their number and their native countries ancient writers, Greek and Latin, are greatly at variance. Neither Homer nor Herodotus makes any mention of a Sibyl; but Heraclitus, the philosopher, who was a little earlier than the father of history, mentions one Sibyl. Aristophanes, Plato and the author of a book, 'Wonderful Stories,' anciently attributed to Aristotle, appear to know of only one Sibyl. Varro, the great Roman polymath, reckons ten Sibyls, namely the Persic, Delphic, Cumæan (of Cumæ in Italy), Erythræan, Samian, Cuman (of Cymæ in Æolis), Hellespontic, Phrygian, Libyan and Tiburtine (worshipped at Tibur). These Sibyls lived in different epodes, and, according to Pausanias the earliest was the Libyan; he refers the Erythræan Sibyl to the time of the Trojan war; his third Sibyl is the Cumæan (of Italian Cumæ), the most celebrated of them all. In the traditional history of the Roman kings, she sold to Tarquin the Proud the Sibylline books. First she offered him nine; these refused, she burned three and offered, at the same price, the remaining six; Tarquin again refused to buy, whereupon other three were burned and the last three offered, still at the same price, and were bought by Tarquin. In these books was written the fate of the Roman people and state. They were entrusted to a commission of 15 members, who were to consult them on occasions of public danger, for direction as to the religious observances necessary to avert extraordinary calamities and to expiate prodigies; they were written in Greek hexameter verses, and hence, the commission of the Quindecimviri Sacris Faciundis was always assisted by two Greek interpreters. The books were preserved in a stone chest deposited in the temple of Jupiter Capitolinus and were destroyed by the fire that consumed the temple in the year 83 B.C. To recover the Sibylline prophecies, the Senate seven years after sent ambassadors to Erythræ in the Troad, who brought back thence about 1,000 verses; other verses were collected in Ilium, Samos, Sicily, Italy and Africa. In addition there came into circulation about this time a great many so-called Sibylline oracles! Augustus, 12 A.D., ordered strict search to be made for these, and a great many of the spurious oracles were burned; the authentic Sibylline verses after being subjected to critical revision, were deposited in the temple of the Palatine Apollo: they appear to have been still in existence as late as the year 400. The Fathers and other Christian authors often quote the Sibylline verses as containing prophecies of Christianity: a memorable instance of this is the coupling of Sibylla with David in the first stanza of the *Dies Iræ — teste David cum Sibylla,* witness David with the Sibyl, as both of them prophesying the destruction of the earth by fire: these Sibylline verses were undoubtedly spurious, most of them composed by learned Jews of Alexandria in the century next preceding our era: such of them as have come down to our time have been collected and repeatedly printed. See Renan, 'Hist. du Peuple d'Israël,' t. v., l. iv., ch. 9, 'La Sibylle Juive.'

Sic'ard, Montgomery, American naval officer: b. Utica, N. Y., 30 Sept. 1836; d. Westernville, N. Y., 14 Sept. 1900. He was appointed acting midshipman in 1851 and rose to be lieutenant in 1860. He was assigned to the Gulf blockading squadron in 1861 and as executive officer on the Oneida was engaged at the bombardment of Forts Jackson and Saint Philip. He assisted in the destruction of the Confederate flotilla in 1862, participated in the passage of the Vicksburg batteries and commanded in the engagement with the Confederate ram Arkansas in that year. He was in command of the Seneca in both attacks on Fort Fisher and was in charge of the left wing in the naval land assault on that fort 15 Jan. 1865. He was engaged in various commands after the Civil War, was inspector of ordnance at the Boston navy yard in 1880–2, chief of the bureau of ordnance in 1882–90, and in 1894–7 he was successively in command of the Portsmouth and Brooklyn navy yards. He was appointed commander-in-chief of the North Atlantic Squadron in 1897 with rank as rear-admiral, but at the outbreak of the Spanish War was placed on sick leave. After partial recovery he asked for active duty and was appointed president of the board of strategy. He was retired in 1898 after 47 years of service.

Sicard, sē-kär, **Roch Ambroise Cucurron,** educator of the deaf and dumb: b. Fousseret, near Toulouse, 20 Sept. 1742; d. Paris 10 May 1822. He was appointed in 1786 director of a school established for the training of deaf-mutes by the archbishop of Bordeaux. In 1789 he removed to Paris, and was chosen successor to the Abbé l'Epée as director of the Paris Institution for Deaf-mutes. He made some important improvements in the system of his predecessor. During the Revolution he narrowly escaped with his life; and having under the Directory become one of the conductors of the 'Annales Religieuses,' it was only by concealing himself that he avoided the consequences of a sentence of exile pronounced against himself and other journalists. On the overthrow of the Directory he resumed his duties at the school of instruction for the deaf and dumb, and in 1816 he was made member of the Academy. Besides other works, he was the author of 'Cours d'Instruction d'un Sourd-muet de Naissance'; and 'Théorie des Signes pour l'Instruction des Sourds-muets.' Consult Berthier, 'L'Abbé Sicard' (1875).

Sic'ca, a weight in India of about 180 grains troy. The sicca rupee, formerly a current coin in India, contained about 176 grains of pure silver, and was equal to about 50 cents.

Sicil'ian Vespers, the name given in history to the massacre of the French at Palermo, Sicily, on Easter Monday, 30 March 1282, because the first stroke of the vesper bell was the signal agreed upon for the massacre to begin. Charles of Anjou, brother of Louis IX. of France, had become master of Naples and Sicily by the defeat and death of King Manfred at the battle of Benevento, and the execution of Conradin, Manfred's nephew, and rightful king, who was only about sixteen years of age. Charles treated his Sicilian subjects as a conquered people, and the French garrisons in Palermo and other places committed the gravest outrages upon the inhabitants. Women especially were victims of the brutal soldiery, and the

Digitized by Google

animosity of the Sicilians toward the French became aroused to a high pitch. Meantime Giovanni di Procida, a nobleman who had been deprived of his estates by Charles for his fidelity to Manfred, was actively seeking to bring about the expulsion of the French from Sicily. Constantia, a daughter of Manfred, was married to King Peter, of Aragon, and Procida appealed to Peter, and also procured the necessary means to enable Peter to move against Charles. The Sicilians, encouraged by Procida, and directly inflamed, it is stated, by a gross insult offered to a young Sicilian bride by a French soldier, planned a general uprising and massacre. At the appointed signal the people of Palermo fell upon the French, sparing neither age nor sex, and cutting off also Sicilian women who were companions of Frenchmen. The number massacred was about 8,000. Messina in April followed the example of Palermo, and while Charles was besieging Messina, King Peter landed at Palermo with 10,000 foot-soldiers and 800 men-at-arms. Charles fled to Calabria, and the succession to the crown of Sicily was settled on James, the second son of Peter and Constantia, the ultimate result being the independence of Sicily under Frederick, a brother of James.

Sicilies, sĭs'ĭ-lĭz, **The Two**, a former kingdom of Italy, consisting of Naples and Sicily. After the fall of the Western Roman Empire (476 A.D.) Lower Italy became subject to the Ostrogoths. About the middle of the 6th century Naples and Sicily fell under the power of the Greek emperors. Both countries were subject to one governor, the exarch of Ravenna, who conducted the administration by means of dukes. During the contest between the exarchs and Lombards there sprung up, in the 9th century, several independent duchies, such as Salerno, Capua, and Tarento. The most powerful was the Lombard duchy of Benevento. Naples, Amalfi, and Gaeta maintained themselves as republics. About the same time the Saracens invaded Calabria from Sicily. They conquered Bari and contended with the Greeks for the possession of Lower Italy, until the Emperor Otho I. (967) subjected Benevento to the German Empire. Germans, Greeks and Arabs now struggled for the possession of this beautiful country. This induced some warlike adventurers, Normans from France, in the 11th century, to try their fortune here. They assisted the Greek duke Sergius against Prince Pandorf of Capua, and were rewarded with the tract of land on which they founded the town of Aversa. More Normans soon followed. In 1047 the 12 sons of Tancred de Hauteville, a count in Lower Normandy, came in with their followers. Among these brothers Robert Guiscard was the boldest and most artful. He contrived to gain over the peasants, and formed out of them his best soldiers. His policy led him to hold Apulia, which he had conquered, as a Papal fief (1053); and he promised likewise to hold as Papal fiefs such tracts as should afterward be subdued by the Normans in Calabria and Sicily. He then (1060) took the title of Duke of Apulia and Calabria. His youngest brother, Count Roger, conquered Sicily in 1072, and, after the death of Count Robert and his sons, united in his own person the whole power of the house of Hauteville. His son and successor, Roger II., completed, after 1101, the conquest of all Lower Italy by subduing Capua, Amalfi, and Naples, at that time celebrated commercial republics. He then received, in 1130, from the anti-pope Anacletus II., by whom he was solemnly infeoffed, the title of King of Apulia, Calabria, and Sicily. Uniting Sicily to his Italian dominions he now called his kingdom the Kingdom of the Two Sicilies. This union of Naples and Sicily continued 150 years. Each country preserved its existing laws.

In 1268 Charles of Anjou, brother of Louis IX. of France, caused the legitimate heir, Conradin of Swabia, to be beheaded. Sicily freed herself in 1282 from the oppressions of the French by the aid of King Pedro of Aragon, and Naples was now separated from it, Sicily being under the kings of Aragon, while Naples was under the Angevin dynasty. This dynasty was dispossessed in 1442 by Philip V. of Aragon, who bestowed Naples on his natural son Ferdinand.

In 1504 Sicily was again united to Naples under the Spanish crown, and governed by viceroys till 1713, when the peace of Utrecht again divided the Two Sicilies, Naples falling to Archduke Charles of Austria, Sicily to Duke Victor Amadeus of Savoy. King Philip V. of Spain reconquered Sicily in 1718, at the instigation of Alberoni, but was forced to cede it to Austria in 1720, Savoy receiving Sardinia in exchange, by which means the Two Sicilies became a part of the Austrian dominions. In 1734 the Spanish Infante Don Carlos, son of Philip V., at the head of an army invaded Naples, conquered both the continental and the insular part of the kingdom, and was crowned at Palermo in 1735 as Charles IV. This change was sanctioned by the treaty of Vienna (1783), and till 1860 this line of the Bourbon family maintained possession of the Two Sicilies, except for a few years during the Napoleonic period, when Joseph Bonaparte and Joachim Murat reigned on the mainland as kings of Naples. In 1759, when Charles IV. ascended the Spanish throne under the name of Charles III., he conferred the kingdom of the Two Sicilies on his third son Ferdinand, and decreed at the same time that it should never again be united to the Spanish monarchy. The reign of Ferdinand extended through the stormy period of the French Revolution and the subsequent European commotions. His successors, Francis I., Ferdinand II. (Bomba), and Francis II. were despotic tyrants who forced the people into periodic revolt, put down with much severity. In 1860, however, an insurrection broke out in Sicily, and an expedition of volunteers from Piedmont and other Italian provinces under Garibaldi sailed from Genoa to the assistance of the insurgents. The result was that the Neapolitan troops were driven from the island. Garibaldi, following up his success, crossed over to the mainland, where he met little or no opposition; Francis II. fled from Naples; the strong places in his hands were reduced; and by a popular vote the kingdom of the Two Sicilies ceased to exist as such and became an integral part of the kingdom of Italy. See ITALY.

Sicily, the largest island of the Mediterranean, belonging to Italy, and formerly a part of the kingdom of Naples or of the Two Sicil-

Digitized by Google

ies. It is only separated from the southwestern extremity of Italy by the narrow Strait of Messina, and extends from lat. 36° 38′ to 38° 18′ N.; lon. 12° 25′ to 15° 35′ E. It is divided into the following seven provinces, each with a chief city of the same name:—

Provinces	Area in sq. miles	Population, 1901
Caltanissetta	1,263	330,972
Catania	1,917	711,923
Girgenti	1,172	371,471
Messina	1,246	548,898
Palermo	1,948	785,016
Syracuse	1,442	427,429
Trapani	948	353,557
Total	9,936	3,529,266

Physical Features.— A range of mountains commencing in the northeastern extremity of the island stretches across it taking the name first of the Neptunian and then of the Madonian Mountains. The whole range bears a strong resemblance to the branch of the Apennines which stretches to the southern extremity of Italy and strongly countenances the opinion generally entertained that it was originally continuous with it and that Sicily consequently must at one time have been not an island but a part of the European continent. The most remarkable natural feature of Sicily and one of the greatest wonders of the world is Mount Etna, which attains a height of 10,874 feet. Compared with this all the other summits of the island are insignificant, the loftiest of them, Calatabellota, Monte Cuccio, Monte Scuderi, and Dinnamare over Messina being all between 3,000 and 4,000 feet. The great majority of the mountains have a far less average height. Their sides are generally covered with magnificent forests. The rivers and streams are very numerous, and not a few of them of classical celebrity, but they are individually insignificant, and in summer are often almost without water. The most deserving of notice are the Giaretta or Simetus on the east coast, the Salso, Platani, Calatabellota or Isbura, and Belice on the south and southwest, and the Termini, Fiume Grande, and Pollina on the north. There are no lakes worthy of the name; the largest is Lentini, not far from the east coast.

Climate.— The climate is excellent, and except in some spots where the air becomes tainted by the effluvia of morasses and stagnant pools very healthy. The thermometer in the hottest days rises to 90° or 92°, and even in the depth of winter very seldom falls below 36°; the medium temperature is 62° 5′. The sky in summer is for the most part beautifully clear and serene, but after the autumnal equinox dews and fogs increase, and rain falls in frequent and heavy showers. The most annoying wind is the southeast or sirocco, which, blowing from the deserts of Africa, is almost intolerable from its stifling heat. Much rain falls in winter, usually commencing in November, and continuing to fall at intervals, often in very heavy torrents, with vivid lightning, and occasional snow-storms, till March, while not unfrequently, particularly in the interior, long droughts prevail from April to November, to serious injury of the harvest and vintage.

Geology.— Etna itself, and the large circular space of which it forms the centre, extending west to Bronte and east to the coast over the whole tract that lies between Catania and Taormina, is covered completely with volcanic products. Granite, with gneiss and mica-schist, has its only large development in the northeast. The Jura-limestone occupies only two small patches; but the series of rocks immediately above the limestone and belonging to the Cretaceous system are so largely developed as to cover at least a half of the whole surface of the island. The rocks of the Tertiary formation occur chiefly in the southeast and the west. The minerals of Sicily are more numerous than valuable. They include argentiferous lead, quicksilver, iron, copper, and antimony in quantities so limited that few of them are worked; lignite, bitumen, petroleum, and naphtha; asbestos, gypsum, emery, alum, rock-salt, nitre, sulphur, and a great variety of marbles, agates, chalcedonies, and jaspers. The most important of all these is sulphur, which has been worked in mines for more than three centuries, and is extensively exported.

Vegetation, etc.— Both the climate and rich soil of the island procure for it both a very large amount and great variety of vegetable products. The hilly regions, presenting alternately bold crags and undulating slopes, are generally clothed with forests of fine timber, among which the prevailing trees are oak, ash, pine, elm, and chestnuts; or covered with pastures, on which numerous flocks and herds are reared. In the lower grounds cultivation is general, and the crops are often remarkable for their luxuriance, though the mode of culture is for the most part unskilful and careless in the extreme. The most important crops are wheat, maize, barley, and lentils, or other pulse. Next to grain the most important objects of culture are the vine and the olive, the orange and the lemon. The produce of the vine is partly dried into raisins, but is much more frequently converted into wines of various kinds, and generally of rich flavor. Other vegetable products deserving of notice are the mulberry, extensively used in rearing silkworms; saffron and sumach; cotton, which has its chief locality near Mazzara; manna obtained by incisions in the bark of a species of ash, various species of fruit, more especially the Indian fig or prickly-pear, on which when in season great numbers of the lower orders subsist, the almond, common fig, date, liquorice-plant, and sugarcane. To these might be added a great number of trees and plants valuable for fruit, fibre, medicinal properties, or the essences extracted from them.

Manufactures, Trade, etc.— The manufactures include the ordinary silk, woolen, linen, and cotton tissues, for the most part of a coarser description; oil-cloths, leather, cordage, glass, earthenware, etc. Trade suffers much from want of inland communication, but the vast extent of sea-coast, and the many valuable products indigenous to the island, should make it much greater than it is at present. The only occupation for which the Sicilians seem to show any particular predilection is that of fishing, for which they possess numerous advantages, the fisheries along the coast being the finest in the Mediterranean. The most important articles of export are oranges and lemons, wines, essences, sulphur, olive-oil, sumach, silk, liquorice, and cream-of-tartar; of imports, colonial produce,

Digitized by Google

cotton and woolen yarn, silk, linen, cotton, and woolen goods, hides, hardware, etc.

Religion, Education, etc.— The Roman Catholic is the established religion and the great body of the people nominally belong to it, though a considerable number of Greeks, who profess the worship of their own church, live in different parts of the island, and more especially in the vicinity of Palermo. The greatest bigotry, accompanied with the grossest immorality, is very prevalent among the higher and has also spread widely among the lower orders. Education is very much neglected. As late as 1864 upward of nine tenths of the population were wholly uneducated. National schools are now, however, everywhere established, and the towns possess commercial and grammar schools. Palermo, Catania, and Messina can even boast of universities, though, that of Palermo excepted, they are very insignificant.

History.— According to early tradition the first inhabitants of Sicily were Cyclopes and Lestrygonians, a kind of fabulous beings, who long furnished the poets with ample materials, of which, among others, Virgil has largely availed himself. Sicanians from Iberia afterward gained such a footing in the island, as to change its name from Trinacria, which it had hitherto borne, to that of Sicania. The Siculi, driven from Italy, crossed the straits, and having vanquished the Sicanians, gave the island the name which it still bears. After a considerable interval the Greeks began to plant colonies on the coast, and founded a number of towns, of which Syracuse, Agrigentum, and Messina became the most celebrated. They were not, however, allowed to remain in undisturbed possession. The island was conquered first by the Carthaginians, and next by the Romans; and on the decline of their empire, it was overrun by the Goths, who retained possession till Belisarius expelled them. In the beginning of the 9th century the Saracens became masters, and continued so till their expulsion by the Normans, who remained long enough in possession to establish the feudal system in all its rigor. For a continuation of the history of Sicily see SICILIES, THE Two, and also ITALY. Consult Freeman, ‹History of Sicily from the Earliest Times› (1891–4).

Sick, Foods for the. That diet is one of the strongest factors in the control as well as in the progress of disease is practically an axiom to this generation, and one appreciated especially by the nurse upon whom falls the carrying out of the doctor's orders. Strict observance of a regimen prescribed by the physician in charge of a case, with no pampering of a patient's preferences and no indulgence of a person's own theories, is the stern duty of one who would most fundamentally and materially alter a diseased or abnormal physical condition. Very frequently there is increased demand for food in sickness, too often associated with partial or complete inability to take it or, if it is taken, to digest it properly; gastric secretions are almost always perverted in an acute or chronic case, and appetite and taste, under normal conditions a safe criterion, must be absolutely disregarded in abnormal circumstances.

Too much care cannot be given to the service of meals during illness. The psychological influence exerted upon a healthy person by the manner of the preparation of food is now proved to be very great as an actual aid to appetite and digestion, though it has been practically ignored for centuries. How greatly exaggerated this influence would be in illness may be readily perceived. Therefore the invalid's tray must be made attractive at any cost of effort or even of time on the part of the nurse; it is her special province, and perhaps the only one in her professional sphere in which she may give play to her æsthetic sensibilities. It is therefore not true that a woman without æsthetic sense makes the best nurse, for this especial reason of attractive service, and for the very potent reason that an invalid with any æsthetic perception (made keener by illness) will need a nurse's sympathy and appreciation of his condition and point of view.

All service should be upon the very best china and linen available, with variation in these if possible; the least novelty or diversion is acceptable, as the strongest people are reduced by illness to a childlike attitude. A freshly cut flower on a tray adds greatly to its first effect upon a patient, and attractive garnishes to even unattractive dishes may be devised by a skilful nurse. The color of paps and gruels is not appetizing; the color of beef juice is absolutely revolting to very many; therefore opaque ware is to be selected for serving such. If a bent tube be used for the patient to take liquids with, much discomfort of sitting up or disgust at seeing what he is taking is avoided. In quantity the service must be underestimated rather than overestimated; sufficient porridge for a day laborer will have little charm for a patient with no appetite. Care must be taken in conveying the tray that nothing upon it be spilled or smeared. Too much stress cannot be put upon these points.

A nurse must know the underlying principles of food values, and their chemical composition, as well as the proper preparation of foods of each class to make its essential properties best available to the weak stomach. She must know that steak or chop slightly broiled is more easily digested than the «well-done» variety; that an egg slightly boiled, or one well mixed with air by beating, gives up its albumen with least resistance to the digestive juices. On the other hand, starchy foods must be long subjected to boiling temperature that the starch-cells may be ruptured, and digestion of them, so difficult even in health, be begun for the invalid. Seasoning is a more important point in sick-cooking than under ordinary conditions, and may be used extensively on account of the mild stimulating action of condiments on the gastric juices, as well as for their flavor, although a judicious nurse will not apply this principle to excess. Tea, chocolate, cocoa, and coffee, may be used with moderation except in certain troubles in which they will be specially forbidden; they combine slight restorative power with some nutritive value, and at least do no harm, especially if the tea or coffee be taken clear.

The time of administering food is another important point. In almost no case is sleep to be interrupted for the sake of a meal. The best times are when the patient has been quiet for a while and can be quiet for at least an hour more; that is, undisturbed by visits from doctor or friends, by baths or bedmaking, or anything

Digitized by Google

tending to the least excitement. If a fever is present the most abundant meal of the day should be given when the fever is at its lowest, as gastric juices are least active in presence of fever.

Food may be selected in some measure with regard to the affected part. Throat and lung troubles demand non-irritating foods, or even those of a soothing character, as flaxseed tea; a disease involving the stomach would demand food the digestion of which is accomplished in the intestines, as carbohydrates or starches; and *vice versa.* The quantity and total amount are determined by the case: a suppurative process demands much and frequent feeding, as it uses tissue and energy at an almost unthinkable rate; the cure of consumption is also largely a stuffing process; in other acute cases food may be withheld for over 24 hours with great benefit, but the diet must be very carefully guarded when food is resumed. Some of the more important foods for the sick are here given, with modes of preparation and some indications of their spheres of usefulness.

Liquid Foods Made of Water.— Used as cooling drinks in fevers.

Lemonade.— This is best prepared by making a syrup of 1 cup of water and ½ cup of sugar, is boiled 5 or 10 minutes. Make the drink as it is needed in the proportions of 2 tablespoonfuls of syrup to 1 of lemon-juice and ½ cup of water. Mineral waters may be substituted for plain water, especially when the stomach is irritable.

Orangeade.— Use 1½ tablespoonfuls of the same syrup as for lemonade, and the juice of an orange — less if the orange is sweet. Pour over crushed ice.

Grape-juice.— Thoroughly clean 1½ cups of Concord grapes, add 1 cup of cold water, and cook 1½ hours in a double boiler. Add ½ cup of sugar, strain, and cool.

Irish Moss Lemonade.— Soak ¼ cup of Irish moss in cold water to cover it; remove this, add 2 cups of fresh water, and cook 20 minutes in a double boiler. Strain, and to ½ cup of liquid add sugar and the juice of 1 lemon.

Flaxseed Lemonade.— Into 1 pint of boiling water put 2 tablespoonfuls of sugar and 3 of whole flaxseed. Steep 1 hour; strain and add the juice of a lemon; serve direct from the ice. This is desirable in throat and lung troubles, giving relief as well as affording some nutriment. It is very soothing in tonsillitis.

Potus Imperialis.— To 1 quart of boiling water and ½ ounce of cream of tartar, the juice of a lemon, and 2 tablespoonfuls of sifted sugar or strained honey. Cover this until cold. This is a useful drink in fevers if the urine is high-colored or scanty.

Egg-water.— The white of one or two eggs well beaten is to be put into ½ pint of ice-water with a little salt or sugar. This may be given to the weakest patient, and will almost invariably be retained, while the albumen will afford necessary nourishment. The water may be flavored with sherry, or may be changed to lemonade, orangeade, or grape-juice. Almost any fruit-water is refreshing to a patient, especially if he is suffering with fever or chronic disease or convalescing. The acids and salts of fruit are valuable food additions, though they may not be relied on to furnish nourishment to any appreciable extent. Rhubarb drink well prepared is very refreshing, and almost always beneficial; green gooseberries and mulberries afford a variety in their season, and all the juicy berries of summer make good drinks. The liquid for all these should be perfectly clear after straining, and never contain any pulp or seeds.

Gum-arabic Drink.— Make with one ounce of gum arabic to 1 pint of boiling water, seasoned with 2 tablespoonfuls of sugar, sherry, and the juice of a large lemon.

Bran-tea.— To 1 pint of wheat bran add 1 quart of boiling water; keep this hot, but boil less than 1 hour. Strain and serve with sugar and cream. Corn-tea is made in the same proportions of parched corn ground in a mortar.

Toast-water.— Cut stale bread in ¼-inch slices, and dry thoroughly in the oven until crisp and brown. Break into small pieces, and add an equal quantity of boiling water; all this to stand an hour; then season with salt, strain, and either chill or reheat. A little wine may be added. This is often beneficial in cases of extreme nausea.

Rice-water.— Wash 2 tablespoonfuls of rice and add 2 cups of boiling water. Stick-cinnamon or lemon-peel may also be added. Boil ½ hour, strain, and reheat or chill as desired.

Barley-water.— Soak 3 tablespoonfuls of barley overnight; boil in 4 cups of cold water for 1½ hours; strain, and season with salt, lemon-juice, and sugar. The starch of barley is very beneficial for diminishing a laxative condition.

Oatmeal-water.— Take ½ cup of fine oatmeal with 1 quart of boiled water; set in a warm place for 1½ hours; strain and cool. It makes an excellent summer drink, is always safe in quantity in the hottest weather, and is valuable in diarrhœa of children.

Macaroni-water.— Indian meal or any of the starchy foods may be used for this water in similar ways. Above all, such waters must be made palatable, and should be served in a manner that does not betray their weak character. By increasing the amount of cereal, and by longer boiling, a gruel may be made.

Oatmeal Gruel.— Boil 1 tablespoonful of oatmeal in 1 pint of water ¾ of an hour; strain it, and if too thick reduce to desired consistency with boiling water. Season with salt.

Oatmeal Gruel with Milk.— This is made by soaking the oatmeal in water overnight in proportions of half as much cereal as water. Boil an hour in the same water, then blend thoroughly with 1 pint of boiling milk and boil 5 minutes more.

Caudle.— Beat 1 egg to a froth, add a wine-glass of sherry and ½ pint of any kind of gruel; flavor with nutmeg, lemon-peel, and sugar.

Gruels are comprised under the head of semi-solids. Discretion must be used in the administration of gruel when symptoms of inflammation are present, since starch in general, and corn or oatmeal gruel in particular, are very heat-productive. Care must always be taken in making gruels to cook them thoroughly, that the starch may be made altogether available to a weak digestion. Arrowroot is advisable as an especially digestible gruel, and of avail even in the presence of irritation of the stomach.

Mulled Wine.— Soak broken stick-cinnamon and ½ dozen cloves in ½ cup of boiling water

Digitized by Google

for 10 minutes. Strain and add the beaten whites of 2 eggs and 2 tablespoonfuls of sugar. Into this pour from a height 1 cup of sweet wine that has been boiled (but not in tinware). Pour from glass to glass several times to make it light.

Pap.— Thicken 1 pint of milk with 1 tablespoonful of flour; cook 10 minutes, and beat in the white of an egg if desired. Corn-starch, rice-flour, and arrowroot are used also in this way as thickening.

Plum Porridge.— Mince 12 raisins, and bring them to a boil in 1 pint of milk; thicken with 1 teaspoonful of corn-starch in a cold-water paste, and boil 5 minutes; strain and serve. Raisins impart a fruity taste that gives variety, and they afford the easily-digested fruit-sugar. This is of service in diarrhœa.

Sago-milk.— Take 1 tablespoonful of pearl sago, wash and soak it overnight in 4 tablespoonfuls of cold water. Boil the sago with 1 quart of milk in a double boiler until the sago is dissolved. Sweeten slightly and serve hot or cold.

Treacle Possett.— Boil a cup of milk and stir in 1 tablespoonful of molasses. Bring this to a boil, and strain before serving.

Milk preparations may be provided in great variety, and often with the most desirable results. The more useful of them are specified below.

Albuminized Milk.— The white of 1 egg, ½ cup of milk, and a pinch of salt are shaken together thoroughly and chilled.

Milk Punch.— To ½ pint of milk add 1 tablespoonful (or less, according to case and individual) of whiskey, rum, brandy, or sherry, sugar, and a few gratings of nutmeg. Mix, cover, and shake well. The milk may be hot if so desired.

Kumiss.— Dissolve ⅓ of a yeast-cake in 1 tablespoonful of lukewarm water; add this to 1 quart of warm milk to which 1½ teaspoonfuls of sugar has been added; fill strong bottles to the neck and cork them firmly; then invert them, and allow them to remain for fermentation at about 80° F. Chill after 6 or 8 hours. Remove the corks with care, or draw off the kumiss with a champagne tap.

Sterilized Milk.— Fill perfectly clean pint bottles with milk almost to the top, and plug with absorbent cotton; place all the bottles in a steamer so arranged that they will not touch the bottom or each other. Immerse in cold water to ¾ their height, and bring this bath to the boiling point; keep it at 170° F. for about 10 minutes. Remove cotton-plugs, and cork bottles with rubber corks if possible, keeping them in a cool place until used; then use the milk only once, never offering a second time even to an infant.

Pasteurized Milk.— This is similarly prepared, but the water is on no account allowed to boil, and is kept at 167° F. for 30 to 60 minutes. Special pasteurizers are available for this purpose.

Peptonized Milk.— Mix thoroughly 5 grains of pancreatic extract and 15 grains of bicarbonate of soda in 2 tablespoonfuls of water; add 1 pint of fresh milk, and keep warm (about 115° F.) in a covered jar for ½ hour; then chill the mixture. If the resulting slightly bitter taste is disagreeable, the preparation may be sweetened. Peptonizing tubes may be bought all prepared for use in this process.

Water and fresh milk, boiled in equal parts, will afford relief in cases of mild exhaustion, being quickly absorbed with the least possible effort. In giving milk to a patient the most important point to observe is very slow administration; it must be eaten rather than drunk, even under normal conditions, and a weak stomach cannot manage its curd in bulk. Lime-water or bicarbonate of soda, added in small quantity to milk in cases of acidity of the stomach, may prevent the formation of curd. In bad cases of nausea milk may be retained if fed by the teaspoon at short intervals. In all cases of milk diet in whole or in part it is safer to pasteurize or sterilize the milk unless one is perfectly sure of its source and its mode of transportation. This would practically obviate any risk. The change from a solid to a milk diet must be made gradually; also, if the case no longer warrants all liquid, the change back to solid must be gradual, as the digestive system will rebel at sudden alterations in regimen. The amount of milk to be given daily, its modifications, and the frequency of administration will be regulated by the physician in charge of the case.

Beef preparations are likewise made in many ways, so as to adapt them to different patients in various circumstances. Those described below will all be found to possess special advantages.

Beef-tea.— A pound of beef cut from the round or neck is cut into very small pieces, put into an earthen or porcelain pot, covered closely, and allowed to soak in 1 quart of cold water for an hour or two. Heat in the same vessel to the boiling point, then allow the preparation to simmer 2 hours, or until the salts and soluble albumen of the beef are quite extracted. Season this, and strain it or not, as desired; remove all fat, however the tea is served, as the least trace of fat is disgusting to a sick person. A perfectly clear liquid may be obtained by stirring in the beaten white of an egg and again straining. This beef-tea is stimulating, but by no means nutritive, as most of the albumens have been precipitated by the heat; so discretion must be used in its administration; since it may excite a weak patient and prevent sleep.

Beef Essence.— Finely mince 1 pound of lean beef (no fat); put into a fruit-jar, cork tightly, and set into a kettle of cold water over a slow fire; let it boil 3 hours, then strain through a sieve, and season with salt and red pepper. Another method of preparing this beef essence, which has some nutritive value in addition to the stimulating quality, is to add 1 pint of cold water to the minced beef in the jar, allow it to macerate for 3 hours, with occasional stirring, and to simmer in the water bath after it has once come to the boiling-point. Strain as before, and wash the remainder with cold water to make the whole measure 1 pint. Vary the flavor if it is often given by bay-leaf, clove, mace, celery, or other aromatic substance.

Peptonized Beef-tea.— To ½ pound of raw lean beef that has been finely minced, add 10 grains of pepsin, and 3 drops of dilute hydrochloric acid. Put in a tumbler, cover with cold water, and stand for two hours in a warm place (about 90° F.), stirring frequently. This should always be used the day it is made, although most of the other beef preparations may be kept sterile on ice for some time.

Digitized by Google

Bouillon and *Consommé.*— These may be given to a convalescent as usually prepared; they are too stimulating, however, for a weak patient.

Beef Juice.— Broil ½ pound of lean juicy beef over a hot fire, turning frequently, merely to the point of heating the meat through; cut the meat into dice, and extract the beef juice with a meat-press or a lemon-squeezer. Heat the extract by setting in a dish of hot water; never apply enough heat to coagulate the juices, as they would be rendered less digestible, defeating the express purpose of this preparation. This is highly nutritive. Broiled beef-tea is the same preparation diluted, as the case or individual may require, by hot (not boiling) water.

Frozen Beef-tea.— It is often desirable to administer nourishment as pleasantly as possible in hot weather, or in a case of high fever. Any of the beef-teas given above may be frozen. In small quantities it is most convenient to fill a pound baking-powder tin, or other tin case, ⅔ full, and pack with ice and salt in a small pail; stir and beat as the mixture freezes until a consistency of mush is obtained.

Beef Juice and Cereal.— Use 1 tablespoonful of thoroughly cooked oatmeal or other cereal to 2 tablespoonfuls of boiling water; add 1 cup of strong beef-tea; bring all to the boiling point; season well, and serve with toast or crackers.

Bartholow's Food.— Soak 1 ounce of sago in ½ pint of milk for 10 minutes. To this add ½ pint of beef-tea, the yolk of an egg, beaten, and seasoning of celery salt. This is considered a complete food.

Scraped Beef Balls.— A small piece of round steak is cut into strips, and the freshly-cut surface is scraped with a rather dull knife, reserving all the soft part of the meat and leaving connective tissue. Form the pulp into balls, using but slight pressure; season with a very little pepper and salt. The balls may be either broiled or cooked in an omelet pan that is sprinkled with salt. Serve on toast, and garnish as prettily as possible to divert attention from the raw appearance of beef. The flavor may be altered, if the patient's digestion allows, by additions of minced celery, chopped almonds or other nuts, butter, or egg albumen.

Raw Beef Sandwiches.— Use the raw scraped beef, well seasoned with salt; cover half a slice of bread that is cut very thin and buttered; press down the other half, and serve. The object is to serve this raw beef (as attractively as possible) because of its nutritive qualities; the rareness, being often distasteful, must be disguised.

Mutton Broth.— Wipe and clean from skin and fat 3 pounds of mutton from the neck; cut in small pieces, and put all into a kettle; cover with cold water and bring slowly to boiling-point; then simmer for more than 2 hours, or until meat is perfectly tender. Strain, skim, and add rice or barley.

Veal Broth.— This may be made with ½ pound of veal, chopped fine, to 1 pint of cold water. Prepare in same way as mutton broth.

Chicken Broth.— Select an older fowl for this, as it makes a more nutritious broth. Remove skin and fat; disjoint and break the bones. Cover with cold water in stew-pan, bring to boiling-point slowly, and simmer for several hours. Season with salt and a little pepper when half done. Strain and remove fat. Rice may be boiled with it at first, and strained out, or it may be added and boiled in the stock.

Chicken Panada.— Chop and rub fine ¼ pound of the white meat of chicken, raw. Mix with ½ cup of fresh bread crumbs and ½ cup of milk; beat in the whites of two or three eggs. Season and poach in little earthen cups.

Oyster foods have also their peculiar values, and a few of the numerous forms of preparation are here given.

Oyster Juice.— Mince with a silver knife 1 dozen fat oysters, put them into a fruit-jar, and stand in hot water for half an hour. Strain the liquid out, skim, and season. This may be diluted or served in concentrated form.

Oyster Broth.— Add ½ pint of cold water before putting the jar, as above directed, in the hot bath. Or the broth may be creamed by the addition of flour and milk.

Oyster Soup.—Rub together 2 tablespoonfuls each of flour and butter, and add 1 pint of hot milk; then drain and add gradually the liquor from one pint of oysters; and when the mixture is brought to a boil add the oysters, which must have been well washed. Cook all together until the oysters begin to grow plump and the edges begin to curl. After seasoning, this must be served instantly with crackers.

Oysters possess a slight nutritive value, and all the nourishment is easily available to a weak digestion, especially if the tough adductor muscle be removed. An irritable stomach will often welcome oysters or clams attractively prepared, and benefit by the nourishment. Clams are much tougher than oysters, and should be given to an invalid only as broth or liquor. Whole raw oysters are frequently served to convalescents.

Clam Broth.— Take as many large clams as desired, and thoroughly wash and scrub them; put in a kettle with a very small amount of water in proportion, and cook until the shells begin to open. Then strain the liquor off through cheese-cloth, season, and dilute if desired. This may be hot, cold, or frozen; it may be kept in this fundamental form for a long time if cooked, and may be varied by flavorings of herbs, or reinforced by pulverized cracker crumbs. By the addition of milk and flour, cream of clams is obtained. The plain broth is very valuable in nausea.

Egg-nog.— This food is made in a number of ways; it is very frequently a staple for invalids of long standing, and a fagging interest in it may be revived by a slight variation. The white and yolk of the egg may be beaten separately or together; the flavoring may be wine, whiskey, brandy, or, if alcohols are not desirable, vanilla or some fruit-juices; usually a little nutmeg is added, and always salt where eggs are used. The milk may be hot or cold, or ½ milk and hot water may be used. A good standard recipe is as follows: 1 egg, ⅔ cup of milk, 1 tablespoonful of sugar, 2 tablespoonfuls of flavoring if it is a wine, 1 tablespoonful if brandy or whiskey, 1 teaspoonful if vanilla. If the white of the egg is beaten the patient will find it more convenient to drink with a glass tube or straw.

Bonnyclabber.— Skimmed milk which has become thick by standing. It is served in the same dish it has stood in, with whipped cream or white of egg.

Digitized by Google

Wine Whey.— Scald 1 cup of milk, add 1 cup of sherry or port wine, and stand 5 minutes. Strain and sweeten if desired. Whey can also be separated by lemon-juice, vinegar, or rennet.

Junket Custard.— Heat lukewarm (not hot) 1 cup of milk; add 2 tablespoonfuls of sugar and 1 teaspoonful of brandy, or ¼ teaspoonful of vanilla. To this add ¼ junket tablet dissolved in 1 teaspoonful of cold water; turn into small molds and cool. This may also be frozen, if packed in a small tin box and surrounded with ice and salt.

Egg Custard.— Mix ½ cup of milk, 1 tablespoonful of sugar, and 1 egg, beaten whole. Put into cups and bake in water.

Caramel Custard.— To the above add enough browned sugar to give color and caramel taste.

Chocolate Custard.—Add melted chocolate to regular egg-custard recipe.

Bread Jelly.— Toast brown the inside of 5 slices of stale bread, and soak in 2 quarts of boiling water with a few slices of lemon; later let this boil to a jelly; strain, sweeten, and eat it cold. A little gelatin may be added, but is not necessary.

Chicken Jelly.— This is prepared like chicken broth, but the stock is allowed to solidify. If poured into attractive molds the jelly will be pleasing to the patient; or it may be cut into cubes and used as a garnish to other things. Fresh chicken meat may be molded with the jelly if the patient can eat it.

Wine Jelly.— Take ½ box of gelatin (or 2 tablespoonfuls of granulated), soak 20 minutes in ½ cup of cold water; dissolve this in 1⅔ cups boiling water, and add 1 cup of sugar, 1 cup of sherry or Madeira, ⅓ cup of orange-juice, and 3 tablespoonfuls of lemon-juice. Strain, mold, and chill.

Lemon Jelly.—Make this with ½ box of gelatin dissolved in ½ cup of water, dissolved in 2½ cups of boiling water; strain and add to 1 cup of sugar and ½ cup of lemon-juice.

Orange Jelly.— Same as wine jelly, using 1½ cups of orange-juice and 3 tablespoonfuls of lemon-juice.

Cider Jelly.— Use cider, dilute or not, in proportion of 3½ cups of liquid to ½ box of gelatin or 2 tablespoonfuls.

Gelatins in combination with other things are beneficial to ill persons, though by no means highly nutritious; a very distinct flavor is necessay to secure palatability, or even digestibility.

Indian-meal Mush.— Mix ½ cup of Indian meal with ½ teaspoonful of salt and ¾ cup of milk; stir this into 1 cup of boiling water and cook 3 hours in double boiler. Serve with sugar and cream.

Rye-meal Mush.—Mix ½ cup of rye meal with ½ teaspoonful of salt and ½ cup of cold water; add to 1¼ cups of boiling water; boil 5 minutes; then cook in double boiler. Serve with maple syrup if possible, or with sugar and cream.

Egyptian Porridge.—Use 3 tablespoonfuls of lentil flour, mixed with salt and 1 pint of water to a paste. Boil 10 minutes, constantly stirring. This is nutritive and agreeable.

Mushes.— Of all the other ordinary cereals mushes may be similarly prepared, the special precaution being to cook the cereal a sufficient length of time, always 1 hour, and longer if the heat is not great. For a weak digestion especially, the starch in these preparations must be made soluble and directly available, and the only way of accomplishing this is by thorough cooking. Most of the ordinary cream soups are possible to the invalid; precaution must be taken, however, to see that they are especially prepared in order that the butter and flour used for thickening this class of soups be not cooked together; for when this fat and starch are mixed it is well-nigh impossible for an impaired digestion to deal with them. When possible, it is well also to have the milk merely heated and not boiled, as boiling detracts from the beneficial results of milk and tends to constipation. The simpler soups in this class, for which recipes can be found in any modern cook-book, are advisable: such as rice soup, potato soup, black or white bean soup, pea soup, creams of celery, corn, or asparagus, tapioca soup, bread soup. If well prepared, these soups would be included under semi-solids, as they must be eaten, not drunk, and contain a good deal of nourishment.

Toast.— This must be made of stale bread from which crust has been removed, and slowly browned over a flame until thoroughly crisp.

Dextrinized Bread.— Stale bread heated in the oven until it has become dark brown.

Torrefied Bread.— Prepared in the same manner as dextrinized, but with greater heat and for a longer time.

Pulled Bread.— Remove all crust from a loaf of loose-textured bread; from the inside portion form strips with forks or fingers, breaking or pressing as little as possible. Put upon a papered pan, and bake until of a golden brown color and crisp. Serve with whipped cream.

Care must be taken with bread for invalids that it be thoroughly baked in loaves small enough to warrant complete killing of all yeast. Freshly baked bread is never to be given to a person with even slightly impaired digestion. A loaf should not be cut for 24 hours after baking. Very frequently in disease the stomach and small intestine cannot hold or digest food. In such cases the introduction of food into the bowel through the rectum, by means of a Davidson syringe, is necessary or advisable. Some of the formulæ enemata more commonly used are here given:

Nutritive Enemata.— When it is impossible for the patient to take food as ordinarily, a nutritive enema will be ordered. Special formulæ will probably be given by the physician, but a safe rule is to add to 1 pint of the foundation liquid (which is usually milk, because of its simple, convenient, and unirritating character, though only about ⅓ absorbed; but may be beef-tea, mild gruel, or eggs) 1 tablespoonful of liquor pancreaticus and 30 grains of bicarbonate of soda. Administer at once after preparation is added.

Special formulæ are given, as they are frequently ordered by name:

Peptone and milk enema: 60 grams peptone, 250 c.c. milk.

Egg and milk: 3 eggs, 3 grams salt, 250 c.c. milk.

Sugar and milk: 60 grams grape-sugar, 250 c.c. milk.

Boas' enema: 250 c.c. milk, yolks of 2 eggs, pinch of salt, 15 c.c. red wine, 15 grams starch or arrowroot.

Digitized by Google

Riegel's enema: 250 c.c. milk, all of 2 or 3 eggs, 2 or 3 pinches of salt, 30 c.c. red wine.

Tournier's enema: 140 to 150 c.c. beef-tea or raw beef juice, yolks of 6 eggs, 2 saltspoonfuls salt, 20 to 40 c.c. red wine.

Wine may be omitted from any of these formulæ.

Leube's Pancreas Enema: Mix 50 grams of pancreas, 150 grams lean meat and 30 grams of fat, all chopped as finely as possible in 150 c.c. lukewarm water. This is an attempt to imitate natural intestinal digestion, is claimed to be unirritating as well as nourishing, and is retained well.

Enemata should always be given at body temperature, in bulk not to exceed 4 to 5 ounces. They must be introduced as high as possible, and be given very slowly; the patient must lie perfectly quiet for at least an hour after injection. During 24 hours 3 or 4 nutritive enemata and one cleansing enema are sufficient for a patient. Trial is often necessary with various formulæ before one is found that can be retained. A very small quantity of opium added may help to retain them, but is not advisable without a physician's special orders.

SMITH ELY JELLIFFE, M.D., PH.D.,
Instructor in Therapeutics, Columbia University, Medical Department.

Sick Man of Europe, The, a term applied to Turkey in 1854, by the Czar Nicholas, in a conversation with Sir Hamilton Seymour, the British ambassador at Saint Petersburg. The czar intimated his opinion that Turkey was sick and dying. He therefore proposed that, to avoid a European war when the demise took place, Russia and Great Britain should come at once to a private arrangement as to the disposal of the Sick Man's effects. As France was ignored in the arrangement, there was some doubt as to the good faith of the czar. The British government rejected the proposal, intimated its belief in the recovery of the Sick Man, and soon after fought by his side in the Crimean war.

Sickingen, zĭk'ĭng-ĕn, **Franz von,** German soldier and Protestant reformer: b. near Kreuznach 2 March 1481; d. 7 May 1523. From early youth he devoted himself to the military life. The protection of the oppressed was his chief occupation. He assisted many a creditor in procuring what was due him from a powerful debtor. He was the enemy of tyranny, and endeavored on every occasion to repress the despotism of princes and the arrogance of the priests. Without being a scholar he loved science and protected men of learning (for instance Reuchlin, whom he defended against the monks of Cologne); and in his castle of Ebernburg many persecuted scholars found a safe asylum. He was a friend of the Reformation, and contributed greatly to extend it in the countries which bordered on the Rhine. At last he engaged in a quarrel with Treves, the palatinate, and Hesse, which drew upon him the ban of the empire. He died soon after the surrender of Neustall, one of his castles, having previously received a severe injury from a fall during a sally. Consult the study by Ulmann (1872).

Sickles, sĭk'lz, **Daniel Edgar,** American soldier: b. New York 20 Oct. 1825. He was educated at the University of the City of New York, but did not graduate. He began to learn the printer's trade, then turned to the study of law, and was admitted to the bar in 1846. In 1847 he entered the legislature as a Democrat, and in 1853 was appointed corporation counsel for New York. In that year he accompanied James Buchanan to England as secretary of legation. Returning to America in 1855 he was elected to the New York State Senate, and two years later became a member of Congress, serving until 1861. He was tried for the murder of Philip Barton Key, whom he shot 27 Feb. 1859, on account of a guilty intimacy with Sickles' wife, and was acquitted. At the beginning of the Civil War he raised in New York the Excelsior Brigade of U. S. volunteers, and was commissioned colonel of one of its regiments, the 70th New York. In September 1861 he was nominated brigadier-general of volunteers, and after some delay the appointment was confirmed, the promotion to date from the day of his nomination. He participated in the Peninsula campaign (q.v.) and the battle of Antietam, under McClellan, and at Fredericksburg commanded a division. Having been made major-general of volunteers in November 1862, he was given command of the Third corps in February 1863, and bore a distinguished part in the battles of Chancellorsville and Gettysburg (qq.v.). At Chancellorsville he cut off the enemy's ammunition train, and by rallying the retreating artillery gained the first success of the day. At Gettysburg his corps withstood the Confederate assault on the Federal left, at the Peach Orchard, and Sickles lost a leg in the encounter. He continued in active service until 1865, when he was sent on a private mission to Colombia and other South American countries. He joined the regular army in 1866, and on 2 March 1867 was brevetted brigadier-general for bravery at Fredericksburg, and major-general for gallant and meritorious service at Gettysburg. During the early years of the reconstruction of the South he was in command of the military district of the Carolinas, but in 1867 President Johnson relieved him of his command and offered him the mission to the Netherlands, which he declined. On 14 April 1869 he was placed on the retired list of the army with the rank of major-general. From 1869 to 1873 he was United States minister to Spain, where he had diplomatic management of the Virginius case; in 1890 was sheriff of New York County, N. Y.; and in 1892 was again elected to Congress. For several years he was president of the New York State Board of Civil Service Commissioners.

Sicyon, sĭsh'ĭ-ŏn, Greece, one of the oldest, most celebrated, and handsome of the ancient cities of the country on the Asopus River, about three miles from its port on the Gulf of Corinth. The site is now occupied by VASILIKA, a village with about fifty families. With adjacent territory the city formed the small state of Sicyonia; at an early period it was ruled by princes, but later became a democracy, and joined the Achæan league, finally coming under the domination of Rome. Sicyon was especially celebrated for its schools of sculpture and painting. It gave its name to a school of art which numbered among its disciples Polycletus and Apelles, both natives of Sicyon. The ancient theatre has been excavated by the American Archæological School at Athens.

Digitized by Google

Siddhartha ("he who has accomplished his aim"), the name given to Prince Gautama Buddha (see BUDDHISM) at his birth in the 7th century B.C. This was his individual name; Gautama, that of his tribe — settlers in Gakja or Gauta, a region situated between the plain of the Ganges and the Himalaya Mountains. Buddha was a title of later origin. Consult E. Arnold, 'The Light of Asia' (1879).

Siddons, sĭd'ŏnz, **Sarah Kemble,** English actress: b. Brecon, South Wales, 5 July 1755; d. London 8 June 1831. (See KEMBLE, ROGER.) She appeared early on the provincial stage, won some local fame at Wolverhampton and Cheltenham, and was secured by Garrick for Drury Lane, where her failure was distinct. After this she acted successively at Birmingham, Manchester, York, and Bath, where she opened in her great part of Lady Macbeth, increasing her reputation to such a degree that she was again engaged at Drury Lane. Her re-appearance in London took place on 10 Oct. 1782, in the character of Isabella in the play of that name, being Garrick's adaptation of Southerne's 'Fatal Marriage.' Her success was complete. The public were astonished by her powers, and she was universally acknowledged to be the first tragic actress of the English stage. She subsequently visited Dublin and Edinburgh with equal applause. She appeared as Lady Macbeth for the first time in London on 2 Feb. 1785, and in that character was declared perfect by competent critics. Christopher North, Hazlitt, Leigh Hunt, Lord Erskine and many others agree in praise of her performances, which were at their best in tragedy, and belonged to the fine old declamatory (sometimes called the "Kemble") school. In solemn majesty, pathos, and minute finish she surpassed Rachel (q.v.). For 30 years she continued to astonish and enchant the lovers of the drama, and having acquired an ample fortune, and been portrayed by Reynolds as the 'Tragic Muse,' took her leave of the stage in 1812, before an audience which melted into tears on the occasion. She, however, performed subsequently at benefits and gave privately Shakespearian readings. She was seen as Rosalind, Ophelia, and Desdemona, with great success; and as Catharine in 'Henry VIII.' discovered a part nearly as well suited to her as that of Lady Macbeth. Consult the 'Lives' by Campbell (1834); Kennard (1886).

Side-saddle Flower. See SARRACENIA.

Side'real Clock, a clock regulated to measure sidereal time, reckoned by sidereal days of 23 hours, 56 minutes, 4 seconds mean solar time, which are measured by the interval between two successive passages of any fixed star over the same meridian, and divided into 24 sidereal hours.

Sidereal System. See STARS.

Sidereal Time, time measured by the apparent motion of the stars. A sidereal day is the time from the passage of a star across the meridian till its next passage. If the stars are supposed to be absolutely fixed and at an infinite distance, a sidereal day is exactly the period of the revolution of the earth on its axis; the effects of the motions of the stars and the motion of the earth in its orbit are insensible. A sidereal day is the most constant unit of time which we possess; but it appears that it is increasing in duration very slowly. The length of a sidereal day is 23 hours 56 minutes 4.092 seconds. A sidereal year is the exact period of the revolution of the earth round the sun.

Siderite, a mineral composed of carbonate of iron, and when pure crystallizing in the rhombohedral system. It then is also known as spathic iron. Another name is chalybite. The faces of the rhombohedral crystals are commonly curved, and there is a perfect rhombohedral cleavage. Besides this it occurs in botrycidal and in globular form, with a more or less fibrous internal structure. Again it is massive, or coarsely or finely granular.

The hardness is 3.5 to 4.5; the specific gravity 3.7 to 3.9. It has a vitreous lustre, and is often more or less pearly. The color varies from ash-gray, through yellowish-gray, greenish-gray, to brown and brownish-red; sometimes it is white. The streak is white. It is commonly translucent or subtranslucent.

In composition it is: $FeCO_3$; carbondioxide 37.9 and iron protoxide 62.1. Part of the iron is usually replaced by manganese, and often by magnesium or calcium.

The principal varieties are (*a*) crystallized, (*b*) concretionary, in globular form, with fibrous structure, (*c*) granular, (*d*) massive, (*e*) oölitic, and (*f*) earthy, with a large admixture of clay. This latter variety constitutes a large part of the clay in stones of the coal formations.

In the United States siderite occurs at Plymouth, Vt.; Sterling, Mass.; Roxbury, Conn.; Antwerp, Jefferson County, N. Y., and at the Rossie iron mines, St. Lawrence County, N. Y., and in North Carolina. Also in Pennsylvania, Ohio and other States, chiefly as clay iron stones in the Coal measures. See AËROSIDERITE.

Sidewinder, a local name in Arizona for the horned rattlesnake (*Crotalus cornutus*), referring to its sidewise method of progression. See RATTLESNAKE.

Sidgwick, sĭj'wĭk, **Eleanor Maitland (Balfour),** English educator: b. Scotland 11 March 1845. She was married in 1876 to Prof. Henry Sidgwick (q.v.). In 1880–2 she was vice-principal of Newnham College, Cambridge, and in 1892 was appointed principal. She was a member of the Royal commission on secondary education of 1894, and has published 'Health Statistics of Women Students of Cambridge and Oxford' (1890), and papers on educational and other topics.

Sidgwick, Henry, English philosophical writer: b. Skipton, Yorkshire, 31 May 1838; d. Witham 28 Aug. 1900. In 1859 he was graduated from Trinity College, Cambridge, where he was fellow and assistant tutor. He took part in the movement for the abolition of tests, and in connection with it he resigned his fellowship in 1869. In 1883 he was elected Knightbridge professor of moral philosophy in his university, and two years later again became an ordinary fellow of his college. Sidgwick's published works are: 'The Ethics of Conformity and Subscription' (1871); 'The Methods of Ethics' (1874; now in 6th edition), a work of great importance, in which he attempts to reconcile utilitarianism with intuitionism; 'The Principles of Political Economy' (1883), of an eclectic

Digitized by Google

character; 'The Scope and Method of Economic Science' (1885), his presidential address to the economic section of the British Association; 'Outlines of the History of Ethics' (1886), an extended reprint of his article on Ethics in the 'Encyclopædia Britannica'; and 'The Elements of Politics' (1891).

Sidi-Bel-Abbès, sē'dē-bĕl-ăb-bās', Algeria, in the department of Oran, lies 48 miles south of the town of Oran, on the Mekerra River. It is a modern walled town, and occupies a height rising from a fertile, healthy and populous plain. Numerous fountains adorn the town. Esparto grass grows here profusely. There is some trade in hides, alfa, cattle, etc. Pop. 23,288.

Sidney, sĭd'nĭ, **Algernon,** English statesman, son of the 2d Earl of Leicester: b. Penshurst, Kent, 1622; d. London 7 Dec. 1682. He was educated under the supervision of his father, whom he accompanied on his embassies to Denmark and to France. He served in 1642 as captain of a troop of horse in Ireland, and in the civil war espoused the cause of Parliament. He was promoted colonel of horse in 1645, was returned to the Long Parliament in 1646 as member for Cardiff, and in 1647 was appointed lieutenant-general of the horse in Ireland and governor of Dublin, but was soon superseded and in 1648–50 was governor of Dover. In 1649 he was appointed one of the commissioners for the trial of Charles I., but while he attended three of the preliminary meetings he was not present at the trial and did not sign the warrant. He is frequently quoted as approving the measure, and later admitted his justification of it, but his plan, though not exactly clear, seems to have been the deposition of the king by an agreement of both houses. He incurred the enmity of Cromwell by his opposition, and during the first three years of the Commonwealth he stood aloof. In 1652, however, he was elected a member of the council of state and attended 82 meetings in the four and a half months before the council was dissolved by Cromwell, being particularly occupied with foreign affairs. He protested against the Protectorate of Cromwell and afterward held aloof from public affairs until the restoration of the Long Parliament by the army in 1659, when he resumed his place and was again appointed to the council of state. In that year he was sent as a commissioner to negotiate a peace between Sweden and Denmark, and while engaged in this mission the Restoration took place. Aware that his part in the civil troubles could but bring him into disfavor with the royal party, he remained in exile until 1677, when he was given leave to return to settle his private affairs. The excitement attending the exclusion struggle drew Sidney again into politics and he made several unsuccessful attempts to enter Parliament, although outside of that body he wielded a considerable influence. He vindicated himself from an accusation of being the head of a great non-conformist plot soon after the discovery of the "popish plot," but his private letters though written with great caution show a deep sympathy for the non-conformists and the Scots as well as an invincible hatred for bishops and Roman Catholics. He was engaged in an intrigue with the French ambassador through whom he endeavored to persuade Louis XIV. to aid the establishment of a republic in England and evidently hoped to gain at least the maintenance of the rights of Parliament. He undoubtedly received pecuniary aid to the extent of 1,000 guineas through the French ambassador, though he evidently used the money for public purposes. He seems to have taken no part in the armed resistance of Shaftesbury in 1682, but in 1683 he formed one of the "council of six" in the "Ryehouse Plot" to organize an insurrection among the Scottish malcontents. He was arrested after its discovery and sent to the Tower, charged with three overt acts of treason, consisting of: consultations amounting to a conspiracy to levy war against the king; invitation to certain Scots to co-operate with his plans; and of having written a treasonable libel concerning the lawfulness of deposing kings. The only witness against him on the first charge was the infamous Lord Howard, the second charge was proven unfounded, and regarding the third though his authorship of the incriminating paper was undoubted, yet there was nothing to show that it was intended for publication. The law demanded two witnesses for high treason. Jeffreys accepted the paper as the second witness required by the law, and on this faulty evidence Sidney was sentenced to death. After a fruitless petition to the king he was executed on Tower Hill. His 'Discourses on Government' exhibit great acuteness, are forcibly written, and contain valuable historical information. They were first printed in 1698, and have been reprinted in 1740, 1751, and 1772. Consult: Meadley, 'Memoirs of Algernon Sidney' (1813); Van Sandvoord, 'Life of Algernon Sidney' (1851); Ewald, 'Life and Times of Algernon Sidney' (1873).

Sidney, Sir **Philip,** English soldier, statesman and poet: b. Penshurst, Kent, 30 Nov. 1554; d. Arnhem, Netherlands, 17 Oct. 1586. After studying at Christ Church, Oxford, and Trinity College, Cambridge, he set off on his travels at 18, visited France, Hungary, and Italy, and, returning through Germany and Flanders, arrived in England in 1575. He became a favorite with the queen, who in 1576 sent him on an embassy to Germany. He had a quarrel with the Earl of Oxford, but the queen interposed to prevent a duel from taking place. Sidney, displeased at the issue of the affair, then retired to Wilton in Wiltshire, 1580, and amused himself with the composition of his celebrated pastoral romance, 'Arcadia.' In 1585 he projected with Sir Francis Drake an expedition against the Spaniards in America, and he had gone to Plymouth to embark on the undertaking, when an express mandate from Elizabeth recalled him to court. Her influence also was exerted to prevent him from being elected king of Poland, "refusing," as Camden says, "to further his advancement out of fear that she should lose the jewel of her times." He was subsequently appointed governor of Flushing, and general of the cavalry under his uncle Dudley, earl of Leicester, who commanded the forces sent to assist the Dutch against the Spaniards. On 22 Sept. 1586, being at the head of a detachment of the English troops, he fell in with a convoy of the enemy marching toward Zutphen. In the rash charge of 500 against 3,000, Sidney received a shot in his thigh, which shattered the bone. An incident

Digitized by Google

that occurred as he was being borne off the field illustrates his character. It is thus recorded by Lord Brooke, his biographer: «In which sad progress, passing along by the rest of the army where his uncle the general was, and being thirsty with excess of bleeding, he called for some drink, which was presently brought him; but as he was putting the bottle to his mouth he saw a poor soldier carried along, who had eaten his last at the same feast, ghastly casting up his eyes at the bottle. Which Sir Philip perceiving, took it from his head before he drank, and delivered it to the poor man with these words: 'Thy necessity is greater than mine.'» His body was carried to England, and after lying several days in state was buried in Old Saint Paul's Cathedral. His brief career, which to many may seem not to justify his great reputation, nevertheless made a powerful impression on English patriotism. So universally was he esteemed that a general mourning for him was observed throughout the whole country. For a month no gentlemen of quality cared to appear in London without mourning garb. He was panegyrized by his contemporaries, and the universities issued three volumes of elegies on his death. His works, besides the 'Arcadia,' consist of the 'Defence of Poesy'; 'Astrophel, and Stella'; a collection entitled 'Songs and Sonnets,' and other poetical pieces. None of this was published in his lifetime, his great contemporary fame being based on the reports of those to whom his manuscripts were communicated. He is best known for his 'Arcadia,' one of the earliest specimens of the heroic romance, written in mingled prose and verse, the latter exhibiting various attempts to naturalize the measures of Roman poetry, and for the 'Astrophel and Stella' cycle of 108 sonnets and 11 songs. Consult: 'Life' by Fulk Greville; also Davis, 'Life and Times of Sir Philip Sidney' (1859); Lloyd, 'Life of Sir Philip Sidney' (1862); Bourne, 'Memoir of Sir Philip Sidney' (1862); Symonds, 'Sir Philip Sidney' (1886); 'Sir Philip Sidney: a Type of English Character in the Elizabethan Age' (1891); Ely, 'Chaucer, Spenser and Sidney' (1894); Marshall, 'Penshurst Castle in the Time of Sir Philip Sidney' (1894).

Sidney Luska. See HARLAND, HENRY.

Sidney, Ohio, city, **county-seat of Shelby** County; on the Miami River, the Miami & Erie Canal, and on the Cincinnati, H. & D., and the Cleveland, C., C. & St. L. R.R.'s; about 40 miles north of Dayton and 65 miles west by north of Columbus. It is in an agricultural region, and has considerable manufacturing interests. The government census of 1900 gives the number of manufacturing establishments in the city at 101, with a capital invested of $1,173,805. There were in these establishments 935 wage-earners, receiving annually a total of $337,610. The raw material cost annually $1,088,669, and the annual value of the product was $1,858,626. The educational institutions are a high school, public and parish elementary schools, two private schools, and a public library. Pop. (1910) 6,607.

Sidney Sussex College, Cambridge, England, was founded in 1594 by Lady Frances Sidney, countess-dowager of Sussex, aunt to Sir Philip Sidney. There are 10 fellowships, 24 scholarships, and a number of exhibitions. The scholarships vary in value from $150 to $300 a year. The college was erected on the site of an ancient Franciscan convent. It consists of two courts much defaced by modern alterations. Oliver Cromwell and Thomas Fuller were members of this college. There are eight church livings in the patronage of the college.

Sidon, sī'dŏn, or **Zidon** (Arabian, *Saida*), Phœnicia (q.v.), on the Syrian coast of the Mediterranean, lies midway between Tyre and Beirut. It is surrounded by a wall with two gates. Its chief interest is historical. It was a wealthy and ancient city, with an excellent harbor and much commercial enterprise. It was watered by the streams of Lebanon, and many allusions to it are found in secular and Scriptural writings. Sidon was referred to as 'The first-born of Canaan'; Homer alludes to the ingenious Sidonians and their artistic handiwork. The town was famous for its manufactures of glass, linen, purple dye, and perfumes. The Sidonians had their own monarch, but it was once subject to Tyre, and later to the Persians. It passed through many vicissitudes, finally passing over to the Moslems (1291). In the 17th and 18th centuries it became the seat of French commerce. It is now called Saidi. Interesting sarcophagi have been found here (now in Constantinople). Pop. 11,000.

Sido'nia, Order of. See ORDERS, ROYAL.

Sid'ra, Gulf of (ancient SYRTIS MAJOR), Tripoli, a wide gulf of the Mediterranean Sea between the main portion of Tripoli and the plateau of Barca. Its coast-line of over 500 miles is beset with shoals and sand-banks, offering no harbor except Bengazi, at the extreme eastern end.

Siebengebirge, zē'bĕn-gĕ-bĕr"gė, Germany, a small chain of mountains near the Rhine, in Prussia, 20 miles above Cologne. Above the main range rise seven lofty summits, whence the name. These rugged heights are all crowned with ancient lordly castles. Ölberg is the highest peak (1,522 feet); while the Drachenfels is the more interesting. Cologne Cathedral was built from stones quarried in these Rhenish mountains. Some of the peaks are ascended by especially built railways. The scenery is romantic and interesting.

Siebert, sē'bėrt, **Wilbur Henry**, American educator: b. Columbus, Ohio, 30 Aug. 1860. He was graduated from the Ohio State University in 1888, studied in Germany in 1890–1, was associate professor of European history at the Ohio State University in 1898–1902, since when he has been professor of that branch. He has published: 'The Underground Railroad from Slavery to Freedom' (1898–9); 'The Government of Ohio' (1903); etc.

Siebold, zē'bōlt, **Karl Theodor Ernst von**, German physiologist and zoologist: b. Würzburg 16 Feb. 1804; d. Munich 7 April 1885. He studied at Göttingen and Berlin, in 1840 was made professor of physiology at Erlangen, in 1845 at Freiburg, in 1850 at Breslau. In 1853 he was made professor of physiology and comparative anatomy at Munich, where to his chair were later added duties as professor of zoology and director of the zoological and zootomical cabinet. His contributions to scientific research

Digitized by Google

are suggested by the titles of his monographs: 'Observationes de Salamandris et Tritonibus' (1828); 'Ueber die Band und Blasenwürmer' (1854); 'Wahre Parthenogenesis bei Schmetterlingen und Bienen' (1856); 'Beiträge zur Parthenogenesis der Arthopoden' (1871). Consult Hertwig's memorial address 'Gedächtnissrede' (1886).

Siebold, Philipp Franz von, German physician and traveler: b. Würzburg 17 Feb. 1796; d. Munich 18 Oct. 1866. He was a son of a professor of medicine at Würzburg, and there received his education. In 1822 he removed to the Netherlands and became sanitary officer at Batavia. He accompanied the Dutch embassy to Japan in 1826 and remained there until 1830. He made a second visit in 1859–62. His books upon the Japanese, their language, the flora and fauna of the country, etc., did much to make that country known to the world. He published: 'Nippon, Archiv zur Beschreibung von Japan' (1832); 'Fauna japonica' (1833); 'Flora japonica' (1835); 'Bibliotheca japonica' (1833–41); 'Catalogus librorum japonicorum' (1845); 'Isagoge in bibliothecam japonicam' (1841); 'Epitome linguæ japonicæ' (1826–53); 'Floræ japonicæ familiæ naturales' (1851).

Siege, in warfare, the surrounding or investment of a fortified place by an army with a view to its capture. The taking of a fortified place may be attempted (1) by surprise, (2) by a sudden onset, (3) by blockade out of gunshot (see BLOCKADE), (4) by a siege, properly so called. In a regular siege the fortress is first blockaded, so as to cut off all intercourse from without, the besieging force encamping just beyond reach of the enemies' guns. Then if any detached works are situated before the fortress, their capture must be effected in order to admit the opening of the trenches. The trenches are formed in the direction of the fortress; but that they may not be enfiladed from thence, they must proceed in a zigzag form. For the protection of the workers trenches called parallels, because they run in a direction parallel or nearly so to the sides of the fortress, are dug at intervals. While the trenches are being opened, the besieged, by sallies and counter operations of every kind, strive to drive off the besiegers, and to destroy their work; and the besiegers make efforts to establish themselves more and more securely, to raise batteries, and then, by means of trenches and advanced parallels, to approach the walls of the fortress; and all the while the artillery is kept constantly playing from the batteries of the besiegers as well as from the works and guns of the besieged. From the last parallel, which approaches very near the fortress, the besiegers prepare to make breaches. Here likewise mining operations are carried on whenever they are found advisable. When at last the breaches are practicable the storming or scaling of the walls follows. See FORTIFICATION.

Among the great sieges in the world's history were those of Troy, Tyre (572, 332 B.C.), Syracuse (396 B.C.), Saguntum (219 B.C.), Jerusalem (70 A.D.), Acre (1191, etc.), Calais (1347), Orleans (1428), Constantinople (1453), Haarlem (1572–3), Leyden (1574), Breda (1625), Rochelle (1628), Magdeburg (1631), Breisach (1638), Taunton (1644–5), Londonderry (1689), Gibraltar (1731, 1779, 1782–3), Prague (1741–4), Leipsic (1757, 1813), Quebec (1759–60), Seringapatam (1799), Genoa (1800), Saragossa (1808-9), Ciudad Rodrigo (1810, 1812), New Orleans (1814), Antwerp (1832), Rome (1849), Sebastopol (1854–5), Kars (1855), Lucknow (1857), Delhi (1857), Gaeta (1860–1), Vicksburg (1863), Charleston (1863–4), Richmond (1864–5), Metz (1870), Strasburg (1870), Belfort (1870–1), Paris (1870–1), Plevna (1877), Khartum (1884), Ladysmith (1900), and Port Arthur (1904).

Siege Gun. See FORTIFICATION; ORDNANCE.

Siegen, zē'gĕn, **Ludwig von,** German inventor: b. about 1609; d. Wolfenbüttel 1680. He was a lieutenant in the Hessian army and invented the art of mezzotint engraving which was learned from him by Prince Rupert and so introduced into England.

Siegen, Germany, Prussia, a town in the province of Westphalia, on the Sieg River, 63 miles east of Cologne. Two castles, belonging to the period of the Principality, are in this town, several Protestant and Catholic churches, and a monument to William I., and a bronze bust of Bismarck. It has always had important mining and manufacturing interests, and is the centre of the mining industry of southern Westphalia. It has large tanneries, foundries, factories for leather and paper, etc. It is on the line of several railways. There is a school of mining and a real gymnasium.

Siegfried, sēg'frēd (Ger. zēg'frēd). See NIBELUNGENLIED.

Siemens, zē'mĕns, **Ernst Werner von,** German engineer and electrician: b. Lenthe 13 Dec. 1816; d. Berlin 6 Dec. 1892. He entered the Prussian artillery in 1834. Having developed scientific tastes, he took out his first patent in 1842 for a process of silver and gold electro plating. In 1842 he went to England with his brother, Karl Wilhelm, to establish the business known there by the firm name of Siemens Brothers. In 1844 he took charge of the artillery workshops in Berlin. He aided in developing the telegraphic system in Prussia, and discovered the insulating properties of gutta-percha which were utilized in underground and submarine cables. He left the army in 1849 and devoted his energies to electrical business, particularly the construction of telegraph apparatus. The first great continental telegraph line, that between Berlin and Frankfort-on-the-Main, was built by him in 1849, and the firm of Siemens Brothers laid six Atlantic cables. The pneumatic-tube system was invented by him and also various modifications of self-acting dynamos. In 1886 he gave 500,000 marks to found an institute of physics and technology. He published 'Positive Vorschläge zu einem Patentgesetz' (1869); 'Gesammelte Abhandlungen und Vorträge' (1881); 'Wissenschaftliche und technische Arbeiten' (1889–91); 'Lebenserinnerungen' (1901).

Siemens, sē'mĕnz, SIR **Karl Wilhelm,** English physicist and inventor: b. Lenthe, Hanover, 4 April 1823; d. London 19 Nov. 1883. He was educated at the gymnasium at Lübeck, the polytechnic school at Magdeburg, and the University of Göttingen. At 19 he became a pupil

Digitized by Google

in the engine works of Count Stolberg, and a year later visited England for the purpose of introducing a method of electro plating, the joint invention of his brother Werner and himself. In the same year the brothers invented a differential governor for steam-engines, and in 1844 he again went to England to patent this invention. From that time he settled in England, becoming naturalized in 1859. Among the many other inventions with which he, in combination with his brothers, must be credited, are the regenerating gas furnace for metallurgical purposes, the process of making steel and iron direct from the ore, which has revolutionized the steel and iron trades, and improvements in the manufacture and laying of telegraph lines. He was elected to the Royal Society in 1862; was one time president of the British Association; and was knighted in 1883. He published ‹On the Utilization of Heat and Other Natural Forces› (1878); ‹The Dynamo Electric Current and its Steadiness› (1881); ‹On the Conservation of Solar Energy› (1883). His ‹Scientific Works› were edited by E. F. Bamber (1888).

Siemering, zē'mĕr-ĭng, **Rudolph,** German sculptor: b. Königsberg 10 Aug. 1835; d. 23 Jan. 1905. He attended the local Art Academy in youth, and afterward became the pupil of Blaser in Berlin. He was invited to take part in the decoration of Königsberg University, and furnished for that purpose medallion portraits of its learned men. In 1860 he produced his ‹Penelope› and in 1860 a sitting figure in marble of King Wilhelm for the Exchange in Berlin; and a terra-cotta statue of Liebnitz, for the Academy of Science at Perth, productions remarkable for realistic modeling, and imposing expression. In 1871 he executed the masterly relief ‹Uprising of the People at the Summons of their King›; and the following year a design for the Goethe monument. His next work was the statue of Frederick the Great for Marienburg. In 1882 he completed the sculpture for the monument of the counts in Berlin. The greatest of his works, however, was the war monument in the market place at Leipsic, ‹ Germany, › as an armed heroine. Worthy also of special notice was the sitting statue of Emperor William I. with the four colossal equestrian figures — King Albert of Saxony, Emperor Frederick, Bismarck, Moltke, and eight figures of soldiers. He was the author of the colossal equestrian statue of Washington whose pedestal is enriched with reliefs and accessory sculptures. This impressive monument was unveiled in Fairmount Park, Philadelphia, May 1897. Siemering's group, ‹ Saint Gertrude Hospitably receiving a Traveling Scholar, › was finished and set upon the Bridge of Saint Gertrude at Berlin in 1896. He was also the author of numerous portrait busts, and occupied the post of royal professor in Ranch Museum.

Siemiradzki, syĕm-ĭ-rädz'kĭ, **Henryk,** Polish painter: b. Grodno government 15 Nov. 1843. He studied art in the Academy of Saint Petersburg, and after a sojourn in Munich, fixed his studio in Rome. Among his best canvases are: ‹Nero's Torches› (1876); ‹The Vase or the Slave› (1879); ‹The Amulet-Seller› (1888); ‹Christ Stilling the Waves.› He also decorated with much skill two ceilings in the Netchaiev Palace of Saint Petersburg.

Siena, sē-ā'nā, or **Sienna,** sē-ĕn'nạ, Italy, (1) Capital of a province of the same name, and an archiepiscopal see, 61 miles south of Florence, occupies a lofty site on the southern frontiers of Tuscany. It is enclosed by an Etruscan wall with nine gates, has a strong citadel, and is in all respects a typical Italian town; the Piazza di Vittorio Emanuele is historical. Siena outranks all the other cities in its art history from the 13th to the 16th centuries (excepting Rome and Florence). This art is largely represented in its public buildings; the fine Gothic cathedral (13th century) has a remarkable façade inlaid with marbles of various colors and with profuse decorations, after a design by Pisano. The interior contains a famous pulpit by the same sculptor (1274); a mosaic pavement inlaid with biblical scenes and magnificent choir stalls of fine renaissance; 6 paintings by Michelangelo; bronze statue of John the Baptist, by Donatello; a high-altar by Peruzzi, etc. In the library are the celebrated frescoes by Pinturicchio, and the finely illuminated choir-books, resting on elaborately carved desks. On the south side of the cathedral is the antique marble group of the three graces, found (1460) in the Palazzo Colonna at Rome. Beneath the cathedral the Church of San Giovanni is enclosed as a crypt. It was formerly a baptistery and contains some fine baptismal fonts and bronze bas-reliefs. The other most interesting churches are: San Domenico, Fontegiusta, Santo Bernardino, Fonte Gaja, Sant Agostino, the Collegiata di Provenzano, etc., all rich in *chef d'œuvres* of painting and sculpture by Sienese and other Italian artists. The city contains numerous and splendid palaces, municipal offices and public institutions, including the Palazzi Tolomei (1205) and Buonsignori; Palazzo del Governo, containing valuable archives (52,000 MSS.); Palazzo Spanocchi (now post-office and telegraph bureau); the Loggia dei Nobili (in imitation of the Loggia dei Lanzi at Florence), and the Palazzo Publico. The Instituto dei Belli Arti contains a fine collection of paintings of the early Sienese school, from the dismantled monasteries, and modern works; the Public Library contains 76,000 volumes and 5,000 MSS.; the Academia dei Fisiocritici contains a museum of natural history; the University (1321) has limited facilities, and but two faculties; there are a lyceum, a technical school, a theatre, and many prosperous charitable institutions and hospitals. Fonte Gaia, Fontebranda — immortalized by Dante — and Fonte Nuova are among the beautiful fountains, and at the southeast stands the Benedictine convent «Monte-Oliveto Maggiore» on the summit of Mount Acorur, with fine frescoes. The Lizza promenade is much frequented. The manufactures are unimportant; trade consists chiefly in common and fine marble.

Its history is somewhat mythical as to origin, and of ancient date. From the Etruscans — its founders — it passed into the hands of the Romans, and then to the Lombards. The people rebelled against the rule of the nobles in the 12th century, and warred with Florence in that and the succeeding century, and in the 14th century they resigned their liberties to the Duke of Milan, after many years of internal strife; especially memorable is the strife of 1480, when Pandolfo Petrucci acquired practical control of

Digitized by Google

the state. Later, the city placed itself under the protection of Charles V. of Spain, and thus imposed upon itself a burden of tyranny, while hoping to be freed from a petty despotism, and the city became the scene of frequent riot and bloodshed. The Sienese then entered into treaty with France. Finally, after renewed hostilities by Spain and Cosimo I. de Medici, Siena was reduced and annexed to Tuscany. In 1859, the city was the first to vote for the monarchy of Victor Emmanuel II., which led to the union of the Italian states. Pop. 28,355. (2) The Province of Siena, in the grand duchy of Tuscany, covers an area of 1,471 square miles, and is divided into two districts, Montepulciano and Siena. There is an important agricultural industry; also an extensive silk industry. The chief products are wheat, wine, and olives. The province is traversed by the Florence-Rome railway which branches off at Asciano toward Siena. Pop. 233,830.

Sienkiewicz, syĕn-kye'vĭch, **Henryk**, Polish novelist: b. Vola Okrzeyska, government of Radom, 4 May 1846. He was educated at the University of Warsaw, published some critical articles in 1869, was for a time editor of 'Slovo,' a journal of Warsaw, and in 1870 sent to press his first work of fiction, 'Na Marne,' rendered into English by the official translator, Jeremiah Curtin (q.v.), as 'In Vain' (1899). In 1876 he came to the United States, where for a time he remained in California. He traveled also in central Africa in 1891. Among his chief works accessible in English are the following, all by Curtin except where otherwise specified: 'The Deluge' (1891); 'With Fire and Sword' (1893); 'Without Dogma' (Young) (1893); 'Pan Michael' (1894); 'Quo Vadis?' (1897), with scene in the Rome of Nero, his best-known book; 'Let Us Follow Him' (1897); 'So Runs the World' (the Soissons) (1898); 'On the Bright Shore' (1898); 'Sielanka and Other Stories' (1898); and 'Knights of the Cross' (1899). Perhaps his best work is to be found in 'With Fire and Sword,' 'The Deluge,' and 'Pan Michael.' In 1905 he received the Nobel prize in literature.

Sierra, Justo, Mexican educator and statesman: b. Campeche 26 Jan. 1848. At the age of 23 he became a lawyer and advocate. After the downfall of President Lerdo, Sierra retired from politics, but soon re-entered public service as a member of the lower branch of the federal congress. In this position his education, oratorical abilities, and intense loyalty soon won for him great influence and prominence. He was called from Europe, where he was serving on an important mission, to become secretary of public instruction. A number of his historical and educational works are used as text-books in the National Preparatory School and in other institutions of learning.

Sierra Leone, sē-ĕr'rä lē-ō'nē or lē-ōn' (Sp. lā-ō'nā), West Africa, a British colonial territory, consisting of a colony proper and a more extensive protectorate. The colony consists of the peninsula of Sierra Leone, about 25 miles long and 12 miles broad, of Sherbro Island and a few islets, and of all the coast strip between French Guinea and Liberia; total area, about 3,000 square miles. The capital, Freetown, is at the northwest extremity of the peninsula. The protectorate extends inland so as to have French Guinea on the north, Liberia on the east and southeast; area, about 30,000 square miles. The surface near the shore, though sometimes rocky, is generally flat, but in the interior are many hills and mountains, varying in height from 500 to 3,000 feet. Some parts are low and swampy; most parts are well watered. The soil, of which only a comparatively small portion is under regular cultivation, is fertile, growing excellent crops of rice, Indian-corn, yams, plantains, pumpkins, and cassava. Sugar, coffee, indigo, ginger, and cotton also thrive well. The fruits include the baobab, cocoanut, banana, pineapple, orange, lime, guava, papaw, pomegranate, etc. The forests are extensive, and the trees in them are often so magnificent as to be converted into canoes capable of containing 100 men. The principal live stock are pigs and goats. Poultry also, particularly guinea-fowls, are very abundant. The fisheries both on the coast and in the rivers are productive. The chief industrial establishments are those in which the palm-oil is extracted and prepared. Boat-building is also carried on to some extent, native cloth is woven, and leather is dressed on a small scale. Trade is carried on chiefly with Great Britain. The total value of imports for the year 1901 was $2,741,430; of exports, $1,520,050. The total tonnage of vessels entered and cleared for the same year was 1,249,808 tons, of which 1,028,941 were British. The principal articles of import are cottons, wines and spirits, tobacco, apparel, haberdashery, flour, salt, etc.; of exports, palm-kernels, kola-nuts, gum copal, ginger, benniseed, etc. The total revenue in 1901 was $960,690, and the expenditure amounted to about $867,500. The strongest religious bodies are the Church of England and the Wesleyan Methodists. The number of white inhabitants is only about 350. Education is denominational, but is assisted by state aid. There are some 80 elementary schools, the number of pupils on the rolls being over 8,000. There is a college at Furah Bay for the education of a native ministry, supported by the Church Missionary Society and affiliated to Durham University; secondary schools for boys and for girls at Freetown, a technical school, etc. Sierra Leone was discovered by the Portuguese in 1463 and first became a British colony in 1787. Soon after, a company was formed with the humane intention of making it a home for free negroes, and proving by their means that colonial products could be raised without slave-labor. In 1800 a grant of the peninsula was made to the company, but in 1807 the company ceded all their rights to the crown. Since then the position of Sierra Leone has varied at different times. Its affairs are now administered by a governor and an executive council of several official members, with a legislative council. One great obstacle to its prosperity is the deadly nature of its climate, particularly to Europeans; but its progress, though slow, has been steady. The natives can live in comfort with little exertion. Freetown (q.v.) is now a fortified coaling station and centre of trade. A railway runs inland for some distance. Pop. about 80,000; with protectorate, about 1,000,000.

Sierra Madre, mä'drā (Sp. mä'thrā). (1) A range of mountains in Southern California, in Los Angeles and adjoining counties on the northeast. (2) A range in the southern part of Wy-

Digitized by Google

oming in Carbon County. (3) The range in Mexico which borders the plateau on the west. It is a continuation of the range on the western border of the Great Salt Lake basin in the United States. In Mexico, the range is much broken; the peaks, except a few, do not exceed 10,000 feet in height. This range is sometimes called Sierra Madre del Pacifico. In Southern Mexico is a range called Sierra Madre del Sur. (See MEXICO.) (4) One of the three principal mountain ranges of the island of Luzon, Philippines. It begins at Caraballo de Baler, in the southeastern part of the province of Nueva Ecija and extends northeast to Cape Engaño, the northeast point of the island. A branch of this range called Mamparán starting at Caraballo Sur, in the northern part of Nueva Ecija, extends to the north. The highest peak is Mount Moises.

Sierra Madre del Pacif'ico. See SIERRA MADRE.

Sierra Madre del Sur. See SIERRA MADRE.

Sierra Morena, mō-rē'nä, Spain, an irregular mountain chain, about 380 miles in extent, which forms the watershed between the Guadiana and Guadalquivir rivers, and extends between the south and the northern boundaries of Andalusia, for which reason it is sometimes known as the Andalusian System. This system consists of three distinct parts. The eastern division through which the railroad and highway pass on the way to Madrid, presents a magnificent landscape. The highest summits are Cerro Estrella (5,500 feet), in the west, and in Estremadura, the Tudia. On the watershed, between the Murtiga and the Huelva near the source of the Odiel, the water fall is great; many chestnut trees and cork oaks are found; also extensive marble quarries. The range abounds in copper, zinc, quicksilver, iron, etc.

Sierra Nevada, nä-vä'thä (Spanish, «snowy range»), (1) The loftiest mountain range in Spain. It extends east and west through Andalusia and Granada, terminating on the Mediterranean shore, where it forms several promontories. Its highest peak, Mulahacen (11,678 feet), is covered by perpetual snow; Veleta, next in height, has an elevation of 11,378 feet. These high peaks are penetrated by deep valleys or gorges, with here and there small, icy lakes, of which the Corral de Veleta extends into an immense glacier 8,580 feet high. The loftiest pass is the Collado de Veleta (9,900 feet), where the snow line is from 8,970 to 9,300 feet high. (2) A mountain range in California, separating the interior basin of Nevada from the valley of California. The highest peaks and the crest line of the range are on the eastern margin. The highest peaks in rank of altitude are Whitney, Tyndall, Dana, Brewer, and Lyell. The chief passes are the Truckee, 7,200 feet, and crossed by the Central Pacific; the Beckworth, 5,190 feet; the Walker, 5,320 feet; Tehachapi, 3,830 feet, crossed by the Southern Pacific. (See ROCKY MOUNTAINS.) (3) A mountain range in Colombia, S. A., 23,779 feet in height. See COLOMBIA.

Sieyès, sē-ā-yās, **Emmanuel Joseph** (the Abbé Sieyès), French politician: b. Fréjus 1748; d. Paris 1836. He commenced his studies at the University of Paris, and when the Revolution broke out he took an active part in furthering its progress, and wrote three pamphlets on the mode in which the three estates were to vote, whereby he was brought into very general and favorable notice. With him originated the idea of a new geographical division of France into departments, arrondissements, and communes. He also took an active part in the formation of the new constitution, and was in 1791 member for the department of the Seine. In 1792 he was deputy for the department of the Sarthe; but generally contented himself with merely recording his vote. During the Reign of Terror he withdrew into the country, but on the downfall of Robespierre he returned to the convention and took an active part in public measures, more especially foreign affairs, conducting several important negotiations with other states. In 1798 he went on a mission to Berlin, and succeeded in securing the neutrality of Prussia. On his return in 1799 he succeeded Rewbell as a member of the Directory, and shortly after succeeded in displacing three of his colleagues, so as to obtain a majority favorable to his views. He afterward, with the assistance of Fouché, closed the Jacobin Club. This measure made him very obnoxious to the extreme Republican party, and under the conviction that faction was now to be kept down only by force he began to look out for a military leader. He thought of several, but fixed at last on Bonaparte. The revolution of the 18th Brumaire was the result; but Sieyès, who hoped he had only obtained a coadjutor, soon learned that he had subjected himself to a master. He did not, however, retire unrewarded, but proved that the simplicity and disinterestedness of which he had boasted were more nominal than real, by obtaining, along with the title of count, grants of lands and other property to the value of at least $250,000.

Siffleur'. See MARMOT.

Siffu, sēf-foo', or **Sibbú,** sēb-boo', a river of the island of Luzon, Philippines. It rises in the eastern part of the province of Bontoc and flows south and east through the province of Isabela to the Rio Grande de Cagayan; it is one of the most important tributaries of the Cagayan in Isabela.

Sigel, sē'gĕl, **Franz,** American military officer: b. Sinsheim, Baden, 18 Nov. 1824; d. New York 21 Aug. 1902. He was graduated from the military school at Carlsruhe in 1843, and was commissioned lieutenant in the army, but resigned in 1847. In 1848 he raised a corps of volunteers to serve in the Baden insurrection and became commander-in-chief of the revolutionists. Arrested by the Swiss authorities in 1851 he escaped and in 1852 came to the United States. He settled in New York and conducted there a military magazine 'Die Revue,' removing in 1857 to Saint Louis where he established a similar paper and also engaged in teaching. At the outbreak of the Civil War he organized a regiment for the Federal army and went to the front, participated in the battles of Carthage, Dug Springs, and Pea Ridge; and in May 1861 was commissioned brigadier-general of volunteers. He was promoted major-general in 1862 and assigned to a corps in the Army of Virginia, which he commanded in the series of operations from Cedar Creek to the second battle of Bull Run. He was appointed to com-

Digitized by Google

mand the Western Pensylvania Reserves in 1863 and in 1864 was transferred to the command of the Department of Western Virginia, successfully defending Maryland Heights against General Early's raid in July 1864, though his force was but 4,000 men against 15,000. He resigned his commission after the war, was editor of the Baltimore 'Wrecker' in 1865–7 and later removed to New York. He was appointed collector of internal revenue in 1871 and elected registrar of New York in the same year. In 1868 he was appointed pension-agent, and later edited the 'New York Monthly,' a German-American publication, and was the author of various essays on military subjects.

Sighing, an act of respiration beginning in an involuntary, often sudden, sometimes prolonged inspiration, in which the diaphragm descends; the expiratory act which follows, and which constitutes the "sigh," being caused by the recoil of the chest-walls and lungs and by the action of the abdominal muscles. Sighing usually illustrates simple respiration as modified by mental or emotional conditions or by some factor of sensation. During strained attention, as when listening to a thrilling speaker, or witnessing an exciting scene, the respirations become very short and quickly recurring, with an occasional long sighing inspiration at intervals.

Sight. See Eye; Senses; Vision.

Sight, Defects of. See Vision, Defects of.

Sigillaria, sĭj-ĭ-lā'rĭ-ạ, a genus of fossil plants found in great abundance in the coal measures. The plant occurs in the form of compressed stems attaining a height of 40 to 50 feet, and a breadth of 5 feet. The stem is seldom found preserved so as to show any structure or even its cylindrical form; it generally occurs as a double layer of coal, showing on the outer surfaces longitudinal furrows due to the arraugement of the leaves on the stem, and at regular intervals the scars produced by the bases of the leaf-stalks. The roots are found preserved in the shale which forms the floor of all coal seams; they were originally supposed to be distinct plants, and have received the generic name of *Stigmaria*. No foliage of any kind has been found connected with the trunk. Some suppose Sigillarias to be allied to tree-ferns, others to *Coniferæ*. King says that if in imagination we delineate a channeled stem of any height between 12 and 100 feet, crowned with a pendant fern-like foliage, furnished with wide-spreading fibrilled roots, and growing in some densely-wooded swamp of an ancient Mississippi, we will then have formed a tolerably close restoration of a sigillaria growing in its true habitat.

Sigismund, sĭj'ĭs-mŭnd (Ger. zē'gĭs-moont), emperor of Germany, son of Charles IV.: b. 14 Feb. 1368; d. Znaim, Moravia, 9 Dec. 1437. He succeeded to the margraviate of Brandenburg on the death of his father in 1378, while his brother Wenceslaus, king of Bohemia, succeeded to the throne. By his marriage to Mary, heir of Louis the Great, king of Poland and Hungary, he became heir-apparent to the throne of these two countries, but on the death of Louis in 1383 the Poles chose Hedwig, Louis' younger daughter, for their queen, and the regency of the Hungarian throne was seized by Charles Durazzo, while Mary was kept in captivity. Sigismund rescued her and on the murder of Durazzo was crowned king of Hungary in 1387. His war against the Turks, though supported by the French and German chivalry, resulted in a disastrous defeat at Nicopolis in 1396, and Sigismund was compelled to escape into Greece. On his return to Hungary in 1401 he found his queen dead, his throne occupied by Ladislaus of Naples, and his brother Wenceslaus maintaining with difficulty his throne in Bohemia, having been deposed in Germany. He was imprisoned by Ladislaus, but escaped, raised a large force and in 1403 succeeded in expelling Ladislaus and subduing the kingdom. In 1411 he was elected emperor of Germany and was crowned at Aix-la-Chapelle in 1414. During the Council of Constance in 1414 he allowed John Huss to be put to death for heresy, an act which resulted in the Hussite war. Wenceslaus died in 1419, but it was not until 1431, when he signed the compact with the Council of Basel, that the Hussites would permit the acknowledgment of his succession to the Bohemian throne. He was crowned emperor in Milan in 1431, and his coronation was repeated in Rome in 1433. The Luxemburg dynasty became extinct at his death, as he was succeeded by his son-in-law, Albert II. of Saxony.

Sigismund I., surnamed The Great, king of Poland: b. 1 Jan. 1467; d. Cracow 1 April 1548. He was the youngest son of King Casimir IV., and in 1506 succeeded his brother Alexander on the throne of Poland. The war with the Russians, which was urged forward by the Lithuanian prince Michael Glinski, gave him employment throughout his whole reign. The peace of Poland was also disturbed by inroads of the Tartars, and of the Wallachians. On the other hand Poland was increased by the addition of Masovia. By his toleration the Reformation spread in Poland, and Protestantism became the prevailing religion both in Grand Poland and Polish Prussia. Sigismund, after the death of his wife, Barbara Zapolika, married a daughter of the waywode of Transylvania and Bona Sforza of Milan. This marriage was the cause of many misfortunes to the country. The Italian soon secured for herself an influence in the government, sold the public offices, and at last placed Piotr Kmita at the head of the administration, which acts contributed to destroy the popularity of the king. Under Sigismund the golden age of ancient Polish literature began.

Sigismund II., Augustus, king of Poland: b. 1 Aug. 1520; d. Knyszyn 14 July 1572. He was son of Sigismund I., and was appointed king in 1529, in the lifetime of his father, and in 1544 obtained the government of Lithuania. His mother, Bona Sforza, allowed him to grow up in luxury and effeminacy that she might be able to continue her influence during the government of her son; but upon his accession he disappointed her expectations. When by the revival of ancient laws he proceeded firmly in curtailing the powers of the nobility they endeavored unsuccessfully to depose him. Bona, universally hated, finally quitted Poland with immense treasures for Italy, where she was poisoned by her paramour in 1557. Under Sigismund the Reformation made great progress in Poland, and many senators, landed proprietors, bishops, and clergy exchanged the Roman

Digitized by Google

Catholic faith for Protestantism. In 1563 Sigismund gave toleration to the different religious parties, and in 1572, at the diet of Warsaw, proclaimed universal religious freedom. With his death the Jagellon race became extinct.

Sigismund III., or Sigismund Vasa, king of Poland and Sweden: b. 1566; d. Warsaw 1632. He was the only son of John III., king of Sweden, and of the Polish princess Catharina, a sister of Augustus Sigismund II. After the death of Stephen Bathori he was invited, in 1587, to become king of Poland, and having sworn the Pacta Conventa was crowned at Cracow. He was a very zealous Catholic, and his principal aim was the extension of the Roman Catholic faith in Poland. On the death of his father, John III., in 1592, he set out for Sweden to take possession of the throne to which he had succeeded, and was crowned in 1594. On his return to Poland he was obliged to leave Sweden under the regency of his uncle, who ultimately reigned over it as Charles IX. Sigismund's refusal to give up the Swedish crown of which he became deprived, involved Poland in a disastrous war with Sweden, which lasted for 60 years.

Sigl, zē'gl, **Georg,** mechanical inventor: b. Breitenfürth, Lower Austria, 1811; d. Vienna 9 May 1887. He was in youth apprenticed to a locksmith, and practised his trade in Bavaria, Würtemberg and Switzerland. In 1832 he took employment in the rapid printing press factory of Hellwig and Müller, and in 1837 introduced the manufacture of rapid printing presses into the hand press factory of Dingler in Zweibrück, and opened a branch factory of the same sort in Vienna, where he constructed the first rapid lithographic press (1851). Later he manufactured rotary presses, and applied himself to improving the locomotive and other machinery.

Sign Languages are of two kinds, the descriptive and the characteristic or indicative signs. Descriptive signs involve an account, more or less complete, of the appearance, qualities, and uses of an object, or the circumstances of an event, for the purpose of description or explanation; and must, from their nature, be varied, like a painting, only by the point of view from which the objects are described, or the capacity and accuracy of the person that describes. The indicative signs, on the contrary, which are employed in common conversation, are usually mere abbreviations of these, involving a single striking feature of the person, or object, or event; as an elephant is indicated by its trunk, a flower by its fragrance, or a town by a collection of roofs. The signs of persons are usually conventional, and derived from some feature, or mark, or habit, but often from an accidental circumstance in dress, etc., which struck the deaf-mute on first seeing the person, and is still referred to when it no longer exists. This form of expression, as developed in certain institutions for deaf-mutes, is of a character which those who value it least admit to surpass speech in the force with which it communicates the feelings and states of mind. Like painting (as Condillac observes) it has the immense advantage of presenting a group of ideas at once, which lose much of their force and beauty by being detailed in the successive words and artificial arrangements of written language. The eye, the hand, the whole body, speak simultaneously on one subject; the representation changes every moment, and these peculiarities, with the elliptical form of expression which is adopted in conversation, give a rapidity to communication by the sign language which, on common subjects, among those familiar with it, surpasses that of speech. If we remark the new shades of meaning given to the same words by the varying attitude and general expression of the speaker, and the accuracy with which a nice observer will discover, in these signs, the thoughts, and feelings, and intentions, even of one who wishes to conceal them, we shall find reason to believe that they are capable of conveying the most delicate shades of thought. Generic and abstract terms, as their objects do not exist in nature, have no corresponding terms of equal clearness in the sign language; and the abbreviated manner in which we express relations by conjunctions, prepositions, relatives, and inflections, can only be imitated by adopting similar conventional signs, which do not easily fall in with the idiom of the language. In these respects, therefore, the sign language wants the algebraic brevity and accuracy which are found in artificial languages, and which render these so invaluable as mediums of thought and instruments of philosophical investigation; at the same time it is capable of describing what is conveyed by these forms, with an accuracy at least as great as that of words, by circumlocution and example. It is worthy of remark that the order of expression in the sign language is that which we term inverted — the subject before the quality, the object before the action, and, generally, the thing modified before the modifier. This language, in its elements, is to be found among all nations and has ever been the medium of communication between voyagers and the natives of newly discovered countries. It is employed by many savage tribes to supply the paucity of expression in their language, or to communicate with other tribes, as has been observed among the Indians of North America. Among the Indians of the western regions of the United States Major Long found it an organized language employed between tribes who spoke different articulate languages. His account, as well as others given by subsequent inquirers, shows that it corresponds very closely with that adopted in the school of Paris; and a Hawaiian, who visited an American asylum for deaf-mutes, gave a narrative of his life in the sign language, which was perfectly understood by the pupils. As a proof that the sign language does possess a universal character in its cultivated form, a trustworthy authority, who himself acquired it in this form, has asserted that he employed it, or had seen it employed, with success, in communicating with an American Indian, a Hawaiian, a Chinese, and the deaf and dumb in various parts of the United States, in England, Scotland, France, Germany, Switzerland and Italy.

Signal Corps. See ARMY AND NAVY MANEUVERS; ARMY OF THE UNITED STATES.

Signal Service, The. See WEATHER BUREAU, THE.

Digitized by Google

Signals and Signaling. The most perfect means for the communication of messages by means of audible or visible signs to distances greater than can be reached by the human voice, consists in the use of electricity; but until the recent invention of wireless telegraphy the use of electricity required a more or less fixed connection between the place signaled from and the place signaled to. Flags of various shapes and colors, cones, balls, drums, movable arms or semaphores (as in railways), blasts of sound, flashes of light, and other signaling media have been adopted for different purposes. Signaling at sea according to the international code is mainly effected by flags, either singly or in groups, interpreted in accordance with the international code-book. The present system is of gradual growth out of the earlier ones devised by Sir Home Popham (1803), Captain Marryat (1817), and others. The old international code introduced in 1857 was superseded by a new one in 1902. The latter was prepared by a committee appointed by the Board of Trade, and took its final shape after foreign governments had been consulted. The new code differs from the old one mainly in having a complete flag alphabet, and in the substitution of three-flag signals for all the four-flag signals of the 1857 code, except in the names of places and of ships. The 27 flags used in the code comprise the "code flag," or "answering pennant," hoisted before a code signal is given and as a sign that a signal has been understood; five pennants, denoting the letters C — G; two burgees, denoting A and B; and 19 square flags, representing the other letters of the alphabet. Some of the alphabetic flags have special meanings when hoisted alone; thus, C means Yes; D, No. From the 27 flags (using only one set) not less than 702 separate two-flag signals can be made, and to the greater number of these a definite meaning is attached in the code: thus, A over B means "Abandon the vessel as fast as possible"; code flag over S, "I want a pilot." The number of three-flag combinations possible with the alphabetic flags is 15,600, thus affording scope for an immense variety of signals of all degrees of importance. PCJ, for instance, means, "You will find great difficulty in getting through the ice at —," the place being indicated by a following geographical signal. The code flag above two alphabetic flags gives latitudes and longitudes; under two flags, numbers. As already stated, in the new code four-flag signals are not used for general purposes. They may be used, however, in spelling words alphabetically; and as there is now a complete alphabet of flags, any word may be spelt in this way, but the code signals, having their own special conventional significations (all given in the code-book), are a means of more rapid communication. There are never more than four flags hoisted at once. When, owing to distance or the state of the atmosphere, the colors of flags cannot be made out, a system of distant signals must be resorted to. There are three systems of these in the code-book, so constructed that any one can be interpreted in terms of the elements of another, and all three in terms of the flag code. These systems involve respectively the use of (1) cones, balls, and drums; (2) balls, square flags, pennants, and whefts; and (3) a fixed semaphore. A square flag is equivalent to a cone point upward, a pennant to a cone point downward, and a wheft or tied flag to a drum. The positions of the semaphore arm, numbered 1, 2, 3 on the opposite side from the indicator, and 4 on the same side as the indicator, represent the shapes of the first two systems. The code signals in all these systems denote things or meanings rather than words, and thus they can be interpreted by ships of all nations. For some purposes what is called the movable semaphore may be used, and the arms of this semaphore may be represented by flags waved by a man standing in a conspicuous place. In this case, however, the French have a different alphabetic code from the British. The Morse telegraphic code of dots and dashes may be used in signaling not only by the electric telegraph, but also in several other ways. The dot and the dash may be indicated by blasts of sound or flashes of light of about one second and three seconds duration respectively, but the excessive use of such signals is liable to lead to confusion. The movements of a hand flag, such as is used in place of the movable semaphore, may also be adapted to the Morse code. In an appendix to the 'International Code-Book' particulars are given regarding sound signals to be made during fog, mist, falling snow, or heavy rainstorms on the whistle or siren and fog-horn (see FOG-SIGNALS); sound signals to be used by vessels in sight of one another; and distress signals, made by means of guns, explosives, fog-signals, flames, rockets, etc. Different nations have different systems of meteorological signals, the most elaborate being that of the United States. For military purposes the field telegraph is extensively used, but the heliograph (see HELIOSTAT) is also in regular use.

Signals, Railway. See RAILWAY SIGNALS.

Sig'natures, Doctrine of, a mediæval theory of medicine, which was carried into practice by those who believed that "God . . . maketh . . . herbs for the use of men, and hath not only stamped upon them a distinct form, but also given them particular signatures, whereby a man may read even in legible characters the use of them." Many names of plants were derived from these "legible characters." Thus, the color of plants often designated the particular kind of diseases to be cured by them. Such plants as the *Sanguinaria*, or bloodroot, so-called from the red juice which flows instantly upon bruising its fleshy stems, or roots, were naturally considered a cure for blood affections; and the herb-robert (*Geranium robertianum*), which assumes a beautiful red tint when dying, would stanch wounds. An infusion of the yellow bark of barberries (*Berberis*) was said to have been a cure for jaundice, as was also the saffron. Form was another index of medical virtues. The liverwort (*Hepatica triloba*), having a three-lobed leaf somewhat in the shape of the liver, and, furthermore, mottled with purple, when old, was a cure for liver troubles; and the saxifrage, the "stone-breaker," so-called from its habit of growing in the fissures of rocks, as well as the stony seeds of gromwell, were believed to be able to break up gravel. The well-known mandrake (*Mandragora*), and the ginseng (*Aralia*), valued by the Chinese, as love-charms and aphrodisiacs, gained their

Digitized by Google

suppositious virtues on account of the fancied semblance of their forked roots to human figures. Even the seeds of ferns, at one time supposed to be invisible, transferred this quality to the possessor of the seeds, who thus himself became invisible; plants resembling the moon in her various stages, as the moon-daisy or the semi-lunate segments of the moonwort (*Botrychium lunaria*) were supposed able, by involved and alchemistic reasoning, to cure uterine diseases, or were made party to magical performances, such as unshoeing horses which trod upon them. The rootstock of Solomon's seal (*Polygonatum*), when cut transversely, shows certain marks, imagined to represent a seal, which the old herbalists thought pointed to its employment as a styptic for wounds, and they told how the crushed rootstock would shortly take away bruises caused by «women's wilfulness in stumbling upon their hasty husbands' fists.»

HELEN INGERSOLL.

Sig'net, in England, one of the royal seals, used in sealing private letters and all such grants as pass the sovereign's hand by bill signed. It is always in the custody of the secretary of state for the home department.

Signorelli, sēn-yō-rěl'lē, **Luca** (called also **Luca da Cortona**), Italian painter: b. Cortona about 1440; d. Arezzo 1525. He studied first under Matteo da Siena, and then under Pietro della Francesca. He began to distinguish himself about 1472, and painted till 1512, or perhaps later. He holds an important place in the history of art as the first who applied anatomical knowledge to painting, and thus became the precursor of Michelangelo. Signorelli painted in the Sistine chapel, at Arezzo, Città di Castello, Cortona, Perugia, and Volterra; but his greatest works are the magnificent frescoes in the chapel of the Madonna di San Brizio in the cathedral of Orvieto. The series comprises the 'History of Antichrist,' the 'Resurrection of the Dead,' 'Hell,' and 'Paradise.' It was commenced by Fra Angelico about 1447, and finished by Signorelli between 1499 and 1504. These frescoes were studied by Canova, and by Michelangelo, who did not disdain to copy some of the figures for his 'Last Judgment.' Among his other works the most worthy of mention are the 'Madonna Enthroned,' the altar-piece of St. Onofrio in the cathedral of Perugia; the 'Adoration of the Magi,' now in the Louvre; the 'Annunciation,' and a 'Madonna,' at Volterra. Signorelli was a man of high character, and attained municipal as well as artistic honors.

Signs and Signboards. The art of sign painting was known among the Greeks and Romans, and specimens of ancient signs have been found at Pompeii and Herculaneum, sometimes painted, but oftener carved. A bush was the sign of many taverns so late as the reign of James I. During the Middle Ages every trade had its emblem, some of which have survived, as the chemist's pestle and mortar, the pawnbroker's three balls, and the barber's pole. Besides these trade emblems, every individual trader might have his own special device: Southey's father, a Bristol linen-draper, for his chose a hare. During the 16th and 17th centuries huge painted signs came greatly into vogue. They were suspended either from projecting metal-work, from a post or an obelisk, or from a sort of miniature triumphal archway, and sometimes cost great sums. These creaking and ponderous signboards proved a source of annoyance, sometimes of positive danger, as when in 1718 one in Fleet Street, London, dragged down a house front, and killed in its fall four persons. So in 1762–70, under act of parliament, the London signboards were either wholly removed or at least affixed to the fronts of the houses; and this example was gradually followed throughout the kingdom, though here and there signposts linger, or have been restored, even in London. One of the oldest and most interesting signs still existing is the «Red Lion» at Martlesham, Suffolk, England, for it was the figurehead of one of the Dutch fleet defeated off Southwold in 1672; but the history even of vanished signboards has no slight interest. A good many signboards have been painted by great artists, Holbein, Correggio, Paul Potter, Hogarth, Wilson, Morland, David Cox, «Old» Crome, Sam Bough, and Sir J. E. Millais (some of which are still extant). In the United States many old and picturesque signs are still to be found in Eastern cities, particularly in Atlantic coast towns. Modern signs are made mostly of metal and wire-netting. See also LETTERING.

Signs, Mathematical, are those symbols which indicate mathematical processes and conditions. $a + b$, $a - b$, $a \div b$, $a \times b$, and $a \sim b$ read a plus b, a minus b, a divided by b, a multiplied by b, and the difference between a and b; $a > b$, $a < b$, $a = b$, $a \approx b$, and $a \equiv b$ read a greater than b, a less than b, a equal to b, a approximately equal to b, and a identical with b; $\int$ is the sign of integration; $\therefore$ denotes *then* or *therefore*, and $\because$ denotes *since* or *because*; $\sqrt{a}$, $\sqrt[3]{a}$, $\sqrt[n]{a}$ represent the square root, the cube root, and the *n*th root of *a*.

Sigourney, sĭg'ėr-nĭ, **Lydia Huntley,** American author: b. Norwich, Conn., 1 Sept. 1791; d. Hartford, Conn., 10 June 1865. She received a good education, showed considerable facility in rhyme at an early age, and many of her pieces were published in the periodicals of the day. For some time before her marriage to Charles Sigourney in 1819, she had been engaged in teaching schools for young ladies. In 1815 she published 'Moral Pieces in Prose and Verse,' which was quickly followed by other works, most of which enjoyed great popularity. Among her principal poems are: 'Traits of the Aborigines of America' (1822); 'Pocahontas' (1841); 'Scenes in my Native Land' (1844); 'Voice of Flowers' (1845). Her prose works are mainly biographical, historical, didactic, and epistolary. In 1840 she visited Europe, and in 1842 gave some reminiscences of the tour in a volume entitled 'Pleasant Memories of Pleasant Lands.' She has been called the 'American Hemans,' and certainly rivals her English prototype in copiousness, having, by her own computation, written 46 works (in whole or in part), and more than 2,000 contributions to about 300 periodicals. Consult the autobiographic 'Letters of Life' (1866).

Sigsbee, sĭgs'bē, **Charles Dwight,** American naval officer: b. Albany, N. Y., 16 Jan. 1845. He was appointed to the United States Naval

Digitized by Google

Academy in 1859, was graduated in 1863, was made ensign in that year, and for his first two years of service was attached to the Monongahela and the Brooklyn of the West Gulf squadron. He took part in the bombardments of, and attack on, Fort Fisher, and in the battle of Mobile Bay. In 1868 he attained the grade of lieutenant-commander. Thereafter he was employed in various duties, being at different times with the Asiatic and North Atlantic squadrons; stationed at the Naval Academy 1869–70; in the hydrographic office (1873–4); and commander of the coast-survey steamer Blake employed in deep-sea exploration for the government. The chief portion of the outfit of the Blake consisted of inventions or adaptations by Sigsbee, and in recognition of these received a gold medal at the London International Fisheries Exhibition and the decoration of the Red Eagle of Prussia from Emperor William I. Promoted commander in 1882, he was successively on duty at the Academy (1882–5); commander of the practice-ship Dale (1883–4), and of the Kearsarge on the European station (1885–6); and on shore duty (1887–90). In 1890–2 he commanded the training-ship Portsmouth, in 1893 was made chief of the hydrographic office, was made captain 21 March 1897, and on 10 April subsequent assigned to the command of the Maine. The Maine was designed at the Navy department, built at the New York navy yard, commissioned 17 Sept. 1895, and the most powerful second-class battleship in the United States navy. In January 1898 the vessel was ordered to the port of Havana, Cuba, arriving there 25 January. There it was met by an official Spanish pilot, and moored to a mooring-buoy chosen by him. At 9.40 o'clock on the evening of 15 February the Maine was destroyed by an explosion in which the entire forward part of the ship was utterly wrecked. Two officers and 264 of the crew perished. The United States court of inquiry appointed to inquire into the catastrophe found that the vessel was destroyed by the explosion of a submarine mine, and that no evidence was obtainable fixing the blame. A Spanish court making a simultaneous investigation reported that the disaster was caused by an internal explosion. It was very generally believed, however, in the United States that the loss of the ship was in some way due to Spanish initiative. Therefore, says Sigsbee in his own narrative, «although the war which followed was not founded on the destruction of the Maine as a political cause, that disaster was the pivotal event of the conflict.» Sigsbee's wise despatches at the time did much to suspend any popular demand for immediate reprisals, while his expert knowledge was of great value to the court of inquiry. He rendered distinguished service during the Spanish-American war as commander of the converted liner Saint Paul, with which 24 May he captured the collier Restormel, securing Cervera's coal supply, and 22 June defeated the cruiser Isabella II. and destroyer Terror off San Juan, Porto Rico. Subsequently he was ordered to command the Texas, in 1900–2 was chief officer of naval intelligence, in 1903 was made commander of the navy yard at League Island, Pa., and promoted rear-admiral. He published: 'Deep Sea Sounding and Dredging' (1880), and 'The Maine' (1899).

Sigurd, zē'goord, or **Sigurde,** a name famous in Scandinavian mythology. According to the legend Sigurd, the Siegfried of the Nibelungenlied, is the posthumous son of Sigmund, son of Volsung, a descendant of Odin; is born in the palace of Hialprek, king of Denmark, and grows up into splendid manhood. With his good sword Gram, which had once been wielded by Odin, he slays the dragon Fafnir, and obtains the golden treasure which it guarded; by eating the monster's heart he is endowed with a wisdom which enables him to understand the songs of the birds. Riding off with his spoil he strikes through a lonely heath, in the midst of which is a volume of flame, surrounding a house in which a fair maiden Brenhyldr (Brunhild in the Nibelungenlied), daughter of Atli, lay asleep, never to be wakened until there came a hero brave enough to ride through the fierce flame. Sigurd enters and wakes up Brenhyldr, to whom he plights his troth, and then rides to the palace of Giuki the Niblung, who wishes Sigurd to marry his daughter Gudrun (Chriemhild). Gudrun's mother gives Sigurd a potion which causes him to forget Brenhyldr, and he marries Gudrun. Her brother Gunnar (Gunther), having determined to marry Brenhyldr, tries vainly to ride through the flames, and so his mother by her magic arts made Sigurd change shapes and arms with Gunnar, and so rescue Brenhyldr. On the bridal bed Sigurd places his sword between himself and Brenhyldr, and the following morning he resumes his shape, and hands her over to Gunnar. No sooner is this done than the power of the elixir passes off, and he sees when too late that he has betrayed his first love. After the lapse of years Brenhyldr is told that she was rescued from the flames by Sigurd, and not by Gunnar as she thought; and her love for the hero gives way to wrath and thoughts of vengeance. She urges Gunnar and his brothers to slay him, but as they had already taken an oath not to hurt him, they refuse. They, however, incite their half-brother to do the deed, and Sigurd is killed as he lay sleeping. The death of the hero revives all the love of Brenhyldr, and lying down by his side with the sword Gram between them, she dies broken-hearted on his funeral pile.

Sika, sē'ka, the common deer of Japan (*Cervus sika*), representing a group (subgenus *Sika*), whose peculiarity is that the antlers have no bez-tine, so that each has usually only four points; the tail is long proportionately, and the ischial white patch is bordered with black. The Japanese deer, abundant in the forests of northern Japan and China, is of small size, dark brown in color and the greater part of the tail white; but in summer the coat is spotted with white. This, and the similar Formosan and Manchurian deer, are often caught in traps and kept as pets by the people; and are capable of thriving in European parks. A closely related form is the Caspian deer (*C. caspicus*) of northern Persia. Consult Lydekker, 'Deer of All Lands' (London 1898).

Sikhim, sĭk'ĭm, or **Sikkim,** India, a native state under British protection, situated in the eastern Himalayas between Nepal and Bhutan, and between Tibet and the province of Bengal. Area, 2,818 square miles. It forms part of the south slope of the Himalayas and ranges in

Digitized by Google

altitude from 18,000 feet in the north to 1,000 feet in the south. The climate is accordingly varied, ranging from tropical to alpine. Formerly most of the area was covered with forest, but the greater part below 5,000 feet has in recent years been cleared and cultivated. The chief products are maize and rice. The mountain roads are good, and the route of British trade with central Tibet passes through the state. The inhabitants are Buddhists of Tibetan stock, and governed by a raja, the capital being Tumlung. The country was formerly controlled by Tibet, but came under British protection by a treaty with China in 1890.

Sikhs, sēks, the name of a religious sect in British India, which has come in course of time to be virtually also the designation of a race or people. Nanak Shah was the founder of the sect, which worships only one omnipotent and invisible God, and whose tenets reflect the broadest religious philanthropy and toleration. Nanak Shah belonged to the Hindu tribe of the Vedis, and was born in 1469 in the village of Talwandi, now the town of Rajapur, in the province of Lahore. Nanak was a profound thinker, and far in advance of the views which prevailed in his day in any part of the world in relation to liberty of conscience and human brotherhood. His impressions in this regard were largely derived from the works of a Mohammedan named Kabik with which he became acquainted in his travels. He sought to introduce simplicity of faith and purity of morals, and to induce Hindus and Mohammedans to live in harmony. He died about 1540, and was buried at Kirtipur, which is therefore a place of pilgrimage for the Sikhs. He well deserved the honor in which his memory is held. His life was pure, he absolutely denied any power to perform miracles, and he taught his disciples to worship God alone. Although peace between men was an essential part of the Sikh religion, the horrible persecutions to which they were subjected by the Mohammedans forced the Sikhs to become a military people, and under their great leader, Govind Sinh, they fought so bravely and successfully as to receive the title of Sihns or lions. They wore a blue dress, let their hair grow, and were always armed. Govind Sinh also instituted the order of «akalis» or «immortals,» in whom to this day rests the supreme direction of religious affairs among the Sikhs. The struggle between Sikhs and Mohammedans, and between independent communities of Sikhs continued, until Runjeet Singh, the son of Maha-Singh, succeeded in establishing himself as despotic ruler of the Sikhs, about the close of the 18th century, and made himself master of a territory comprehending the whole Punjab and adjoining districts, with an area of 69,000 square miles. After the death of Runjeet Singh, and while his son, Dhulip Singh, a minor, was the nominal ruler, war broke out between the British and the Sikhs, in 1845. The struggle lasted with varying fortune, and intervals of temporary submission on the part of the Sikhs, until the decisive battle of 21 Feb. 1849, when the Sikh power was completely broken, their territory being annexed in the following month to the British empire in India. The Sikhs have since proven faithful friends of the British, and never wavered from their allegiance at the time of the great Mutiny. They are among the best of the British Indian troops. See also INDIA; RELIGIOUS SECTS.

Sikino, sē'kē-nō or sē-kē'nō (ancient, SIKINOS), Greece, an island east of Melos, belonging to the Cyclades. It is 10 miles long by three wide. It has a rugged mountainous surface, but the soil is fertile. Wine is the staple. Its chief town is situated on the brow of a lofty precipice. In ancient times the island belonged to Athens, and in the Middle Ages to the duchy of Naxos.

Siksika, sĭk'-sĭ-kâ («Blackfeet,» by which name they are popularly and officially known), an important tribe and confederacy of the Algonquian stock of North American Indians, the confederacy comprising the Siksika proper, the Kino or Bloods, and the Piegan. They should not be confounded with the Blackfoot division of the Teton Sioux on Standing Rock reservation, N. D. The early Siksika home was the country north of Lesser Slave Lake, but in the middle of the 18th century they appear to have lived on the west side of Lake Winnipeg, whence they were forced westward by the Crees; 40 years later the Siksika proper occupied southern Saskatchewan River, while the Piegan lived on its headwaters, after which time the latter, followed by the Siksika, moved down to the Missouri River. Early in the 19th century the home of the Siksika was northern Montana and the adjacent part of British America, extending from the Rockies to the junction of Milk River with the Missouri, and from Musselshell River in Montana to Saskatchewan River in Canada. The component tribes of the confederacy are now gathered on reservations within these limits, the Siksika and the Kino or Bloods being mainly under Canadian rule, while the Piegan, who constitute about half the confederacy, are chiefly in Montana. Both the men and women are tall and well formed; they practised polygamy, and on the death of the husband his wives became the potential wives of his eldest brother, while his property descended to his sons, or, if he had none; to his brothers. These Indians were always noted for their warlike character, their hostilities being conducted chiefly against the Cree, Crows, Shoshoni, Kutenai, and Flatheads. They relied mainly on the buffalo for subsistence, their food, clothing, shelter, and some of their implements and utensils being derived from this useful animal. They lived in skin tipis, and besides bags and cases of hide or parflèche, made implements and utensils of stone, bone, horn, and wood, but no pottery or basketry. Marriage within the gens was prohibited, but this rule is not now strictly observed. Each gens had its chief, and the chiefs of the gentes chose the tribal chief, but the power of the latter was in the main only advisory. The Siksika are nature worshippers, their principal deity being the sun, whose wife is the moon, and whose surviving child is the morning star, while physical objects and forces are minor deities. In the latter part of the 18th century these tribes were estimated at 12,000, but they lost about a third of their number by smallpox in 1836, and in 1858 aggregated only about 7,300. The number of Siksika, Bloods, and Piegan on reservations in Alberta is now about 5,000, and the pop-

Digitized by Google

ulation of the Piegans on the Blackfoot reservation in Montana is 2,043. F. W. Hodge,
Smithsonian Institution, Washington, D. C.

Si'lage, or **Ensilage,** green fodder preserved in a succulent state by exclusion of air, where it undergoes certain changes. In the United States Indian corn (*Zea mays*) is pre-eminently the crop for silage, so when other crops are utilized a designatory adjective is prefixed, as clover-silage, etc. Silage may be stored in silos, or air-tight structures, made of wood, brick, stone, concrete or iron, and either circular, square, octagonal or rectangular in section, the round wooden silo being the most common, because lumber has been the cheapest material and a cylindrical vessel requires the use of less material, contains less waste space, and presents the greatest strength, pressure being distributed equally at all points from the centre. When placed in silos, the fodder is usually cut or shredded into short lengths so that it will occupy less space, incorporate less air and undergo less fermentation. In Europe grass is frequently stacked in the open or put into clamps or pits without cutting it into lengths. The use of the silo in one form or another dates back to antiquity, the clamp being probably the oldest form. About a hundred years ago, this method of preserving fodders attracted attention in Europe, and in 1875 Dr. Manly Miles of Michigan, and in 1876 F. Morris of Maryland, introduced the system into the United States. Many extravagant claims were advanced in its behalf by early enthusiasts, and lack of knowledge led to many failures, so that the progress made was small for some years. In 1882 but 92 farmers could be found who used the silo in the United States. The work of Professors McBryde and King, of the Wisconsin and other agricultural experiment stations, made the position of the silo and silage secure.

The size of the silo is important, serious losses occurring from lack of proportion between the size of the silo and the amount of silage fed daily. The exposed surface is usually too great. The upper layer, if exposed, spoils; hence about 1.2 inches should be fed each day from the whole surface and 2 inches would be better. A cow will consume 35 to 40 pounds per day, and if a cubic foot weighs 40 pounds, we may allow 5 to 6 square feet by 2 inches thick per cow per day. Silos less than six feet in diameter are not considered to be practical on account of the friction of the walls preventing the contents from settling properly, and the greater surface in proportion to bulk means greater percentage of loss. Deep silos are preferable to shallow ones, as a 36-foot silo will store nearly five times the amount that a 12-foot one will, the diameters being equal. King calculates that the average weight of a cubic foot of silage from a silo 10 feet deep is 18.7 pounds, while the average from one 36 feet deep is 42.8 pounds. All silos should be at least 20 feet deep, and 30 feet is better. The pressure of the silage when settling increases with the depth at the rate of 11 pounds per square foot for each foot of depth, hence, at 10 feet down the lateral pressure is about 110 pounds per square foot; at 20 feet, 220 pounds, and at 30 feet, 330 pounds; therefore, the hoops should be larger, stronger, and closer at the bottom of the silo than at the top, the first one starting six inches from the bottom, the second a foot above the first, increasing the space six inches with each hoop until near the top they are finally four feet apart.

The crops used for silage include corn, millet, common red and alsike clover, rye, oats, pea-vine, sorghum and alfalfa. The making of silage from several of these crops is in a more or less experimental stage. The low cost and ease with which heavy crops of corn can be produced; the slight losses sustained in the silo (2 to 10 per cent), and the few objectionable features that corn silage has, render it the general purpose crop. The percentage of losses which occurs in drying corn fodder in the field under good conditions is about the same as that attending its loss when converted into silage. The cost of growing and placing a ton of silage in the silo generally varies between $1.75 and $2.50. The Southern dent varieties produce the heaviest crops, and, if they mature sufficiently in the district, are generally grown. The best time to cut corn for silage is when the kernels are mature, but the stalks, leaves and husks green, as under these conditions less fermentation and other losses occur. Millet has been tried to a small extent. Clover makes good silage, but the unavoidable losses are higher than with corn. This crop should be cut when the bloom has begun to turn brown. Rye and oats, owing to their hollow stems which carry considerable air, are subject to serious loss in weight when made into silage. Pea-vine silage is a by-product of canning factories. Alfalfa silage is still in the experimental stage. Grass is used for silage in the United Kingdom.

THE AVERAGE PERCENTAGE COMPOSITION OF SILAGE (HENRY).

	Water	Ash	Protein	Crude fibre	Nitrogen free extract	Ether extract
Corn	79.1	1.4	1.7	6.0	11.0	0.8
Red Clover.	72.0	2.6	4.2	8.4	11.6	1.2

THE AVERAGE DIGESTIBILITY OF SILAGE (HENRY).

	Dry matter	Protein	Crude fibre	Nitrogen free extract	Ether extract
Dent corn, grain milk stage to mature	64	52	62	69	85
Flint corn, ears glazing	75	65	77	79	82

When corn is nearly mature before being siloed it will contain from 50 per cent to 100 per cent more dry matter and nutrients than these figures show, be more palatable and probably more digestible. The digestibility of corn silage and dry fodder corn are about the same, both being somewhat less digestible than green fodder.

Silage is pre-eminently a food for the cow and its use will largely remain with the dairy farmer. Feeding trials with dairy cows show that silage usually gives better results than a corresponding amount of dry fodder. It has been ascertained that the use of silage produces from 4 to 5 per cent more milk and fat per 100

Digitized by Google

pounds of dry matter fed, due to the silage being more acceptable, and the stalks of corn being cut up in the silage and eaten, instead of rejected as when fed in the form of corn fodder. In feeding great care must be exercised not to leave unconsumed and putrifying silage about the stables as the odor may taint the milk. Several milk-condensing factories refuse the milk from silage-fed cows. Experts may detect a silage odor or flavor in milk from silage-fed cows, but this is of little import, as such milk, and butter made from it, are now sold to critical customers in cities at high prices. When used for fattening cattle, silage produces a more watery carcass than dry fodder. It is a good feed for sheep, being especially useful for ewes with lambs at foot. It is not adapted to pig feeding nor to work horses, but small amounts may be fed to idle horses.

Consult: King, 'Physics of Agriculture'; Bulletin 83, Wis. Agri. Exp. Station, Madison, Wis. (1900); Woll, 'A Book of Silage'; 'Modern Silage Methods' (1903); Henry, 'Feeds and Feeding.'

SAMUEL FRASER,
Professor of Agronomy, Cornell University.

Silao, sē-lä'ō, Mexico, a town in the state of Guanajuato, situated on the Mexican Central railroad, 15 miles southwest of Guanajuato. It is the centre of a rich agricultural district, and manufactures cotton and woolen goods. Pop. about 18,000.

Silas Marner, a novel by George Eliot (1861). It is the story of a poor, dull-witted Methodist cloth-weaver whose life has been wrecked by a false accusation of theft that he has been unable to disprove. He is saved from despair by the filial love of a little child whom he has found by chance. Sixteen years afterward the real thief is discovered and Silas' good name is restored. This simple framework serves the author as occasion for presenting some of her most successful pictures of middle and low class life. By many critics the book is ranked as the best of her works.

Silay, sē-lī', Philippines, pueblo of Negros Occidental, on Guimarás Strait, 10 miles north of Bacolod. It is a large and prosperous town open to coasting trade, and is a telegraph and military station. Pop. 14,537.

Sil'berrad, Una L., English novelist: b. Buckhurst Hill, Essex, May 1862. 'The Success of Mark Wyngate' (1902), attracted much favorable notice. Other works of hers are 'The Enchanter' (1897); 'The Lady of Dreams' (1901); 'Princess Puck' (1902); 'The Wedding of the Lady of Lovell' (1904).

Silchester, sĭl'chĕs-tėr, England, a village in Hampshire, seven miles north of Basingstoke, of special archæological interest. Here are the ruins of Caer Segeint, or Calleva Atrebatum, a Roman town, the main features of which are an amphitheatre, and the city walls, 2,760 yards long. The foundations of a basilica, forum, baths, and a temple, have also been excavated, and rings, coins, seals, broken pottery in abundance have been found near the surface. Antiquarians have given the place much study.

Silene, a large, widely distributed genus of the pink family (*Caryophyllaceæ*), having opposite leaves, and five-merous flowers, with a more or less inflated calyx. The silenes are either annual or perennial, and of varying habit and inflorescence. Many species are viscid pubescent, as *Silene virginica*, *S. caroliniana*, and *S. viscosa*, the last the catchfly, which is carnivorous to a slight degree, and holds its victims by its stickiness. In general, however, the viscid stems prevent crawling insects, such as ants, from stealing honey, and both common and generic names refer to this characteristic. *Silene nutans* and *S. noctiflora* are now naturalized in America and are faded and unattractive in the daytime, but are in full bloom, with starry white petals at night, attracting night-flying insects by their fragrance. Another naturalized silene, found at the borders of fields, is the *S. vulgaris*, a glaucous tall plant, known as bladder campion, cowbells, behen, and spattling or frothy poppy. The first two names refer to the inflated calyx, which is much more conspicuous than the white notched petals protruding from the top, and in fruit is nearly globose, nodding in cymose panicles. It is of papery texture, tinted pale green flushed with rose, and is reticulated with delicate veinings. It is said that English peasants have eaten its young shoots, tasting like green peas, instead of asparagus. The moss-campion (*S. acaulis*), a tufted perennial covered with reddish purple flowers, is common to Arctic regions and mountains; the sweet-william catchfly (*S. armeria*), with rose-colored flowers; and the fire pink (*S. virginica*), whose crimson flowers blaze in southern dry woods, are all cultivated, to which the northern wild pink (*S. caroliniana*) might well be added, as it has many rose-colored or white flowers in very early spring.

Silent Partner, called at various times and places a dormant, sleeping, or special partner. In commercial phraseology a member of a firm or corporation whose name does not appear publicly in the concern, but who shares the responsibilities and liabilities of the organization. Generally a partner of this sort takes no active part in the management of the business, outside of giving monetary support or receiving his portion of the profits. See PARTNERSHIP.

Silenus, sī-lē'nŭs, represented in ancient mythology as the mentor and companion of Bacchus, the god of wine. Silenus, according to the legend, was generally drunk himself. He is sometimes represented as treading out grapes, and other times as riding on an ass with the infant Bacchus in his arms.

Silesia, sĭ-lē'shĭ-ạ (German SCHLESIEN), a former duchy belonging to Bohemia, now divided between Prussia and Austria.

Prussian Silesia is a province situated in the southeastern part of the kingdom, between Bohemia and Russian Poland. It has a length of 230 miles, an average breadth of 80 miles, and an area of 15,563 square miles. The province is traversed lengthwise by the great longitudinal valley of the Oder. That river flows through the province from southeast to northwest, and with its numerous right and left branches drains practically the whole of its area. To the west of this great valley the surface is taken up by the eastern slope of the Sudetic Mountains, with its numerous spurs and minor ranges. East of the Oder the land rises in several more or less isolated and hilly, but not high, plateaus. Nearly nine tenths of the forests are coniferous. Silesia is rich in mineral resources. Its coal deposits are the rich-

Digitized by Google

est in Germany. Iron and zinc are mined in large quantities, and lead and silver are also found. The total value of coal, zinc, lead, and iron mined in 1901 amounted to over $68,000,000. The climate in the lowlands is favorable for agriculture, and the valley of the Oder is very fertile, and one of the richest wheat and barley regions in the empire. Oats, rye, buckwheat, potatoes, and fruit are also raised in large quantities, and there is some viticulture. The textile industry is the most important, next to which follow the metal industries and others depending on mining and quarrying, such as the manufacture of cement, porcelain, and glass. Lumbering and the manufacture of paper, beet-sugar, starch, and liquors are also important. Besides the main Oder there are scarcely any navigable waterways. There are about 2,500 miles of railroad. Pop. about 4,800,000. The capital is Breslau.

Austrian Silesia is a crownland and duchy situated between the southern part of Prussian Silesia and Moravia, and bounded on the southeast by Galicia and Hungary. It measures 115 miles from northwest to southeast, with a breadth of 20 miles, and an area of 1,987 square miles. The northwestern part belongs to the Sudetic Mountains, the southeastern to the Carpathians, and in the middle is the transverse valley of the Oder. The chief mineral products are coal and iron, the coal amounting to nearly 5,000,000 tons annually. Agriculture is confined to the central lowlands, and yields grain, sugar-beets, and fruit. The industries are more important; there are machine shops, steam textile mills, beet-sugar factories, distilleries, etc. There is a considerable transit trade in Austrian wines, salt, and also in beef. Pop. about 720,000. The capital is Troppau.

In the early Middle Ages Silesia was inhabited by a Slavonic people supposed to have supplanted an earlier Germanic population. In the 10th century it was incorporated with Poland. In the latter part of the 12th century it was made a separate duchy by the intervention of Frederick Barbarossa, and from this time Silesia began to undergo Germanization, chiefly by the immigration of German colonists. In the 13th century the duchy was divided into numerous semi-independent principalities, which sought the protection of Bohemia against Poland. By the middle of the 14th century they had become actual vassals of the Bohemian king, and in 1526 they passed with Bohemia into the possession of the house of Hapsburg. In 1675 Frederick William, the «Great Elector» of Brandenburg, laid claim to Silesia based on a former agreement of mutual succession. The emperor refused to recognize the claim, and the three Silesian wars followed, which ended in 1763 with the supremacy of Prussia over what is now Prussian Silesia.

Silhouette, sĭl-oo-ĕt′, is the representation of the outlines of an object filled with black in which the inner lines are sometimes slightly drawn in white. The name comes from Etienne de Silhouette, French minister of finance in 1759. He strove by severe economy to remedy the evils of a war which had just terminated, leaving the country in great exhaustion. At the end of nine months he was obliged to leave his place. During this period all the fashions in Paris took the character of parsimony. Coats without folds were worn; snuff-boxes were made of plain wood; and, instead of painted portraits, outlines only were drawn in profile. All these fashions were called *à la Silhouette;* but the name remained only in the case of the profiles, because the ease with which they may be drawn, or cut out of black paper, makes them popular, though, considered as works of art, they have little value. Some faces — those with a marked profile — are easily taken in this way; while others lose their character entirely, particularly those whose traits are well harmonized. These representations may be taken very well from the shadow of a person on a paper held on the wall; and, in order to make the shadow more steady, it is well to rest the head on a book or the like, put between the face and the paper. The paper is then cut according to the outline of the shadow, and the outer surface pasted on black paper.

Silic′ified Wood, a variety of the minerals quartz or opal in which the mineral is pseudomorphous after wood. Opalized wood is wood changed into opal; petrified wood includes either of the above as well as wood changed into coal (see Palæobotany). According to J. D. Dana the trees now silicified in Arizona seem originally to have flourished on the shores of an inland lake, into which they fell and became water-logged; then they were buried beneath volcanic material of a highly silicious character which underwent alteration through the action of water setting free more silica than the water could hold in solution. As the wood decayed this silica was deposited in its cells until finally the woody fibre completely disappeared and what was once wood became quartz. As this change took place only particle by particle, the minutest cells of the wood are preserved and may be seen under the microscope. In the great petrified forests of Arizona, recently made a government park, there are trunks of trees three or four feet in diameter and over 100 feet in length, completely changed to quartz. Over the whole section are scattered petrified trunks and fragments from the size of a hickory-nut to several feet in diameter. At one place in the park a petrified tree has fallen across a ravine about 50 feet wide, forming a natural bridge. This Arizona petrified wood has been extensively exhibited and sold under the trade names of «jasperized wood,» «agatized wood,» and «woodstone,» having been manufactured into tiles, paper-weights, cane and umbrella handles, and many novelties, while complete transverse sections have been mounted as table-tops. The material is partly jasper, richly colored red and yellow by the oxides of iron, and partly translucent chalcedony, with occasional spots of clear quartz and amethyst. Silicified wood abounds in the Rocky Mountains, while a similar forest exists in the Yellowstone Park. Opalized wood is also common, especially in California and Oregon.

Sil′icon, in chemistry, one of the nonmetallic elements, symbol Si, atomic weight 28.4. Next to oxygen it is the most abundant element found in the earth. It does not occur in nature in the free state but in combination with oxygen (silica) and with oxygen and various metallic elements as potassium, sodium, aluminium, calcium, etc., in the form of silicates. Sil

Digitized by Google

con may be prepared by heating a mixture of metallic sodium and the double flouride of sodium and silicon ($Na_2SiF_6 + Na_4 = 6NaF + Si$); also by action of heat on a mixture of magnesium and silica (sand). It exists in three allotropic forms, an amorphous brown powder, a graphitoidal, and a crystalline variety. The amorphous form is insoluble in all acids except hydrofluoric; it dissolves in potassium hydroxide to form a silicate; and burns in the air at high temperatures to SiO_2. The crystalline variety is very hard, is but little if at all attacked by hydrofluoric acid or potassium hydroxide, and cannot be burned. Silicon forms compounds with oxygen, sulphur, chlorine and some others but the most important are the oxide SiO_2 and the salts derived from the various silicic acids.

Silica SiO_2, oxide of silicon, occurs very abundantly in nature both in crystalline and amorphous forms. Quartz, a very pure form of silica, crystallizes in six sided prisms terminated by six sided pyramids. The finer crystals of quartz are called rock crystal while the imperfectly crystalline variety is known as quartzite. Of the amorphous forms we have opal, agate, amethyst, flint, sand, etc. Silica can be obtained in a fine state by melting sand or a silicate with sodium carbonate whereby a silicate of sodium is formed. This is dissolved in water and hydrochloric acid added. Silicic acid separates in a gelatinous condition. The whole is evaporated to dryness, heated for a time a little above the boiling point of water, and then washed with dilute hydrochloric acid. The silica is left behind as a gritty white powder insoluble in water and in most acids. Hydrofluoric acid dissolves in, however, with the formation of silicon tetrafluoride (SiF_4). It also dissolves in alkalies to form silicates. Not acted on by heat except that of the oxyhydrogen blow pipe which fuses it. Silica, generally in the form of sand, is used largely in the preparation of mortar, glass, and pottery. In metallurgical operations it is used as a flux with ores containing limestone with which it forms a glassy slag which floats on the molten metal carrying with it many impurities from the ore. Silica forms a number of hydrates which have acid properties and from which a vast number of salts are derived. A great many very complex salts of these silicic acids are found in the earth's crust, the metallic elements being usually sodium, potassium, magnesium, aluminium, calcium and frequently small amounts of other elements. Some of the best known silicates are the minerals feldspar, mica, garnet, talc, meerschaum, etc. Clay is largely a silicate.

Sil'ius, Titus Catius, Italicus, Roman poet: flourished about 25–101 A.D. At Rome he applied himself to the bar, and became a celebrated orator and advocate. He was consul at the time of Nero's death, and incurred some reproach for assisting in that tyrant's prosecutions, but acquired honor from his conduct in the proconsulate of Asia, assigned to him by Vespasian, from which he retired into private life, and collected books, statues, and busts of eminent men. He finally retired to his seat in Campania, where he died. The only work of Silius which has reached modern times is an epic 'Punica' in 16 books, written with more diligence than genius. It takes as its theme the Second Punic war, according to Livy and Polybius, and contains occasional splendid passages; the description of the passage of Hannibal across the Alps is particularly admired. There are editions by Drakenborch (1717, 4to), Ruperti (Göttingen 1795–8, two vols. 8vo), and Bauer (Leipsic 1891–2).

Silk and Silk Industry. Silk is the queen of all the fibres, and its introduction into the arts and manufactures originated in China 3,400 years before the Christian era. In 2650 B.C., Si-ling-Chi, empress of China, invented silk tissues, which contributed so immensely to the prosperity of her country that she was placed among the Chinese divinities under the name of «Sien-Thsan,» signifying «the first promoter of silk industry.» Thence the art traveled to India and Japan, and finally to Europe in 552 A.D. The Moors imported sericulture into Spain about 910. Greece and Italy undertook sericulture in the 12th century. Silk culture was next undertaken in France, «and silk became so common,» says Mezerin in his chronicles, «that in the year 1347 as many as a thousand citizens of Genoa appeared clothed in silk in a public procession.» In England silk was scarce, even so late as the reign of Elizabeth. The story is related that Henry IV. of France had indulged the fancy to stock the grounds of the Tuileries with mulberry trees; in 1600 he procured silk-worm eggs from Italy, and this patriotic king took other measures to encourage the nascent industry. James I. of England, hearing the news across the channel, set to work in 1608 to imitate him at the royal domain of Oatlands. Then the thought occurred to some of the more progressive and independent nobles of the English court that the time had arrived to have done with importing luxuries from the Continent. There were the fair and promising possessions in America which should be made to yield the mother country silk at least. A half century previous, in 1552, Cortes had experimented with partial success in the same product among the Aztecs in Mexico. The time seemed propitious now to reap great profit from such an undertaking. The Earl of Southampton was among those who showed the most interest in the project. In a mandate to this earl, who was treasurer and counsel to the Company of Virginia, James wrote: «Right trusty and well-beloved, we greet you. Whereas we understand that the soil in Virginia naturally yieldeth store, of excellent mulberry trees, we have taken into our Princely consideration the great benefit that may grow to the Adventurers and Planters by the breeds of silk-worms and setting up of silk works in those parts. And therefore of our gracious inclination to a design of so much honor and advantage to the public we have thought good, as at sundry other times, so now more particularly to recommend it to your special care, hereby charging and requiring you to take speedy order that our people there use all possible diligence in breeding silk-worms and erecting silk works, and that they rather bestow their travell in compassing this rich and solid commodity than in that of tobacco, which, beside much necessary expense, brings with it many disorders and inconveniences.»

It was from Italy that those skilled in the making of silk carried the industry into France. But at the end of the 17th century, after the revocation of the Edict of Nantes, 1685, the

Digitized by Google

workers in silk fled in crowds from France and tried silk manufacture, with more or less success, in Switzerland, Germany, Austria, and England. The French Revolution also influenced the migration of silk-weavers from France to other lands. Those two events were chief causes in the distribution of the industry throughout Europe, and eventually in the United States.

Sericulture in America.— Shipwreck overtook the expedition sent out from England by the Virginia Company under Sir George Summers, and not till four years later was the actual beginning in silk culture made. In London, in the meanwhile, the merchants and noblemen who had advanced money on the future products of the Virginia plantations were not satisfied with the results. Nothing substantial was forthcoming. Even the profits on the tobacco crop were small, and after the king's decree against the importation of tobacco something like panic ensued among the stockholders in the Company of Virginia. In 1619 they got the sanction of the king, and the exclusive privilege of taking negroes from Africa into slavery in the colonies. In 1622 peremptory and urgent directions were forwarded to encourage silk-culture. In 1629, a charter of incorporation was granted to the silk throwsters of London. Aid was promised by the Crown to colonists who entered heartily into the work, and punishments were ordered for those who neglected it. The Colonial legislature passed an act requiring ten mulberry trees to be planted on every hundred acres. The fine for neglect to do this was 20 pounds of tobacco. The same act included a premium of 50 pounds of tobacco for every pound of reeled silk produced.

But the most strenuous effort amounted to little. The king and the Company of Virginia had a falling out, and the latter was bereft of all rights and powers. Another king came to the English throne. In 1666, all acts giving bounties for silk or requiring mulberry trees to be planted in Virginia were repealed. An interlude occurred in silk-culture until the last years of the century when several French Huguenots settled in South Carolina. These were skilled workmen and they were in earnest in their endeavor to cultivate silk in profitable quantities. Contemporary with them was an energetic Englishman, Sir Nicholas Johnson, who formed a colony in the same province which was known for more than a century by the name of Silk Hope. The demand for raw silk in England soon increased by reason of the establishment of a silk-throwing mill at Derby, in 1719, by Sir Thomas Lombe. During the first 35 years of the 18th century of the silk industry was also introduced into Louisiana and Georgia. But notwithstanding the efforts of essayists and the premiums and bounties offered by colonial assemblies and by the English Parliament, the planters could not be stirred to much activity in raising silk.

From 1750 to 1772, the period of its greatest activity before the Revolution, the export of raw silk averaged only 500 pounds per annum and rarely exceeded 1,000 pounds in a single year.

For many years after the War of the Revolution premiums and bounties for planting mulberry trees and for producing raw silk were authorized by a number of States. In New England, New York, New Jersey, and Pennsylvania especially, great interest was taken in the subject. Ezra Stiles, president of Yale College, and Benjamin Franklin, of Philadelphia, were among the most notable promoters of the movement. In Dec. 1825, the subject of silk-culture began to receive national attention, being brought before Congress by a resolution of inquiry introduced by Mr. Miner, of Pennsylvania, and referred to the Committee on Agriculture. This committee reported favorably in the spring of 1826, the report including a resolution directing the Secretary of the Treasury to cause to be prepared a well-digested manual on the growth and manufacture of silk. Inquiries for information on the subject were sent out by the Secretary, Mr. Richard Rush, in 1826; and from the replies and other material a manual was compiled entitled «Letter from the Secretary of the Treasury,» dated 7 Feb. 1828. Six thousand copies were printed by order of Congress. This document became known as the «Rush Letter»; it contains 220 pages, besides illustrations of machinery, and is a carefully executed work.

This favorable action and the publication by Congress at the same session, and at many subsequent sessions, of other documents relating to silk-culture, together with the serious consideration of the subject by the Congressional Committee on Manufactures, as well as by the Committee on Agriculture, enlisted general attention. Sericulture gained the public ear. Legislatures of several States passed bills for its encouragement, and a most determined effort was made to place silk-growing on a paying basis. For ten years all went well. Silk conventions were held in Maryland, New Jersey, New York, and Connecticut, between December 1838, and April 1839, and there were many other gatherings devoted to the cause.

End of the Sericulture Bubble.—The sericulture bubble in the United States burst in 1844. Notwithstanding the favorable climatic conditions both in France and the United States for the growth of mulberry trees and the rearing of silkworms and cocoons, silk-culture has dwindled in both countries, because more remunerative occupations are afforded by other lines of industry. Although in France the raisers of cocoons and reelers of silk are protected by a considerable bounty, payable by the French government to her citizens as against the Italians, that country produces to-day less than 4 per cent of the world's supply of raw silk. Her silk manufacturers are well content to purchase, as America does, the raw silk from Italy, Japan, and China, in all of which countries the ruling rates of wages are much less than in France and very much less than in the United States. Both France and the United States pursue the same fiscal policy of admitting raw silk free of duty and therefore both are on a par in this respect. Under this policy France produces only a small portion of the raw silk needed for its silk manufacturers, while in the United States silk-culture, which was introduced simultaneously to its stimulation in France 300 years ago, has practically ceased to exist, although since 1844 sporadic attempts to revive it have been made in California and Kansas, and more recently in Georgia.

Digitized by Google

Courtesy of the Philadelphia Commercial Museum.

A SILK SPINNING FACTORY IN CHINA.

Digitized by Google

Digitized by Google

From first to last the results of fully 150 years were required to demonstrate in the South that the culture of silk could not be made there a paying occupation. As a pursuit it never crowded out the cultivation of the tobacco plant; and when cotton was introduced as an agricultural staple, the effort to maintain the silk product was relinquished without a struggle. The real reason of the failure was always plain. The cost of producing reeled silk has ever remained less in Italy and the Orient than elsewhere. The unpaid labor of the negro slave and the untutored Indian, it was believed, would contribute to the reduction of that competition. It never did, however. Neither the African nor the savage took kindly to reeling the cocoon, and the skilled hand of the white had to be employed. That hand in this country cannot be employed for a few cents a day. Without doubt the white mulberry tree will grow and flourish in great abundance in California soil. Silkworms can be raised there apparently without limit. But when the time arrives in California or in the South to harvest the cocoons the same old difficulty comes to pass that was encountered by the people who believed that the slaves brought from Africa, together with the native Indians, would reel the cocoons without cost.

To the practical person of experience in silk-culture and silk manufacture, it has seemed evident enough the last 40 years that the effort to establish sericulture in any part of the United States is misdirected. It has been the testimony of all engaged in the industry and acquainted with facts that sericulture in the United States offers no pecuniary inducement.

During the period of protection afforded to sericulture in the United States by the National Government, in addition to the bounties voted by many States, revenue duties were imposed on foreign raw silk, as follows:

1816 to 1831, 15 per cent ad valorem.
1831 to 1841, 12½ per cent ad valorem.
1841 to 1842, 20 per cent ad valorem.
1842 to 1846, 50 cents per pound.
1846 to 1856, 15 per cent ad valorem.

After 1857 raw silk was free of duty, although 10 per cent duty had to be paid till 1865 on any Asiatic silk which was reshipped from Europe to the United States, because coming from countries beyond the Cape of Good Hope. The foreign invoice value of this "reshipped Asiatic" during the years 1858–65 amounted to $1,174,624. The amount of duty paid between 1843 and 1857 exceeded $1,000,000. In that year all duties on raw silk were removed.

Sewing-silks and Small Wares.— The making of sewing silk had become a household industry in New England, at first by hand and later by machinery. The manufacture of silk trimmings of various kinds was commenced in 1815 at Philadelphia, and ribbons in 1829 at Baltimore. In 1838 Wm. H. Horstmann, in Philadelphia, had power looms made from his own designs; and he introduced in this country power-loom weaving for narrow textile fabrics and small wares simultaneously with the first power-loom in Basel, Switzerland. A successful competition was established with nearly all articles of passementeries of French manufacture. Gold laces were made by power by Mr. Horstmann several years prior to the first attempt in Europe. At Baltimore, in 1840, there was a factory using 15 or 20 Jacquard looms in making silk and worsted vestings. But these were the days of relatively small things. Some raw silk was imported to supply these establishments. The importation of raw silk in 1830 from Great Britain amounted to $17,985, from France $3,240, Italy $8,153, China $89,696. Total value $119,074. In 1837 the total value of the importation had risen to $211,694; in 1840 to $234,235.

The United States census compilation for the year 1840 gives the production of raw silk for the previous year in the United States as 61,552 pounds, valued at $250,000. The capital employed in silk manufacture is stated as $274,374. Probably the consumption of raw silk, both domestic and foreign, during any one year in the period under consideration, did not exceed a value of $300,000, and the goods made may have been worth $600,000, or even more, since the sewing-silk made in Massachusetts in 1837 was valued at $150,000.

The following are summaries of the United States census returns of the American silk industry in 1850 and 1860:

	1850	1860
Number of manufacturing establishments	67	139
Amount of capital employed	$678,300	$2,926,980
Number of operatives, males	603	1,585
" " " females	1,220	3,850
Total operatives	1,723	5,435
Amount of wages paid	$297,416	$1,050,224
Value of products, sewing silk	$1,209,426	$6,607,771
" " " silk cloth	17,050	
" " " fringes, gimps and tassels	583,000	
Pounds of raw silk consumed	not reported	462,965

1860.—Three events that occurred about the year 1860 were destined to exert a marked influence on the silk industry of the world. Two of these events may be classed as political and one as industrial, but all and each greatly influenced industrial-commercial consequences which flowed therefrom.

In the United States when the Civil War began in 1861 it was essential of course to provide money for the National Government. At this time the duty on silk goods imported was 24 per cent ad valorem. Among the new duties that were imposed on imports for revenue only was 30 per cent, on 2 March 1861, and then 40 per cent 5 Aug. 1861, on manufactured silk. During a short time before and after the outbreak of hostilities business of almost every sort was paralyzed; the imports of raw silk and of silk goods alike fell off materially. The following statistics of imports indicate the trade movements of the period:

Years	Pounds of raw silk imported in the United States	Foreign invoice value of silk goods imported
1858	422,658	$21,229,538
1859	388,597	28,080,366
1860	297,877	32,961,120
1861	361,891	23,657,269
1862	132,460	7,588,376
1863	250,740	12,890,760
1864	407,935	20,597,723
1865	290,021	8,439,145
1866	567,904	28,508,696

Digitized by Google

It was apparent though that the war duty had given impulse to the silk industry both at Paterson, N. J., under the leadership of the Ryles, the Tilts and of C. Lambert, all of whom were English born, and at South Manchester, Conn., by the Cheneys. When the tariff was again advanced on 30 June 1864, and this time not only for revenue but for protection, to 60 per cent, there was an immediate show of activity among those engaged in silk importing to consider the possibilities of manufacturing at home. They saw the commercial advantage of supplying their deficiencies in supplies of imported goods by more rapid manufacturing at the domestic centres of the industry. They installed power-loom weaving in their mills which at first were small in size, but rapidly grew larger. Thus it was that the manufacture of ribbons and broad goods was largely influenced at the outset by the importers themselves. Likewise those already engaged in the effort to satisfactorily weave silk fabrics here received a fresh stimulus. They had had a long up-hill struggle, owing largely to lack of a sufficient number of skilled silk-weavers in the country. Lack of sufficient capital also greatly hindered its development.

England decreed free trade by the Cobden treaties of 1860, whereby the silk duties of 15 per cent were abolished, and thereafter in Great Britain all silk goods have been entered free of duty. In the same year at Adlisweil in Switzerland, the first large silk mill to operate power-loom weaving on the factory system was established in Europe by the Schwarzenbachs. It started with several hundred power-looms, all operated by water power.

Power-loom Weaving.— Prior to this period the European production was for the most part on hand looms. The aim became at once to overcome the advantage of cheap labor there by power-looms here; and a considerable development of the silk business by power-looms was made within a few years after the passage of the high tariff bill. A prejudice was encountered at first, however, in favor of the foreign make of goods.

William Strange, of Paterson, who erected there a large ribbon plant in 1868, and whose father and uncle had been large importers of ribbons for many years at New York, met this prejudice by boldly stating, «We manufacture the same goods from the same material, by the same workmen and on better looms.»

The demand for skilled labor was constantly attracting a large immigration from the silk manufacturing centres of the continent and from Great Britain. The effect of this impulse given by power-loom weaving of silk goods in the United States was marked. It soon came to be admitted in the New York market that domestic ribbons were quite as good in manufacture and pattern as the imported. That concession steadily increased among buyers, and in time it applied to all the products of the American silk mills. The protective duty did not affect merely the weaving machinery alone, but it touched every branch of the silk manufacturing industry. This protective tariff, allied with Paterson's abundant water power, its proximity to New York (33 miles) and good facilities for transportation, resulted in the making of Paterson. Locomotive works, iron works and rolling mills, cotton and woolen mills, linen thread mills must be scheduled in any list of the manufactories that city possesses; but the leading and most noted feature of its industries is its many silk mills, and the multiplied prosperity of these has been the direct result of the tariff bill of 1864.

For the year 1870 the United States census returns showed that the value of manufactured silk in Paterson amounted to $4,263,260. The population counted 33,579, of whom 12,868 were of foreign birth. These included 5,124 natives of Ireland, 3,347 English, 1,439 Germans, and 1,360 from Holland. There were also French weavers from Lyons, Italians and Swiss. It was beginning to be demonstrated that the silk-makers' art, transplanted from Europe, had a fair prospect of becoming domesticated in the United States.

On 26 June 1872 the Silk Association of America was organized in New York as the outcome of a call issued on 12 June by the Silk Industry Association of Paterson. The proclaimed object was co-operation in all measures that in any way affected the common interest of silk-making in the United States.

Centennial Exhibition of 1876.—The American silk exhibit at the Centennial Exhibition, held at Philadelphia during six months of the year 1876 attracted great attention day after day, and excited much surprise by the variety and excellence of fancy silks, ribbons, handkerchiefs and scarfs displayed and woven on the spot. The discovery was made by the newspapers and general public that silk fabrics made in the United States met many wants of the consumer.

Among the foreign observers, one wrote to the 'Courier' in Macclesfield, the headquarters of the English silk manufacture, that, in his opinion, the English silk manufacturers had acted wisely in not exhibiting their goods in competition, as they would have exposed their inferiority in quality and price. «I noticed at the Exhibition,» the writer continued, «that our neighbor at Leek had had the courage to send exhibits of sewing-silk, but any one comparing them with the cases of the Nonotuck or Corticelli Silk Company, Belding Brothers, or Brainerd, Armstrong & Company, would not fail to notice their inferiority, in lustre and finish. In silk piece goods and dresses, I was quite astonished at the magnificent goods shown by Cheney Brothers, Dexter, Lambert & Company, Hamil & Booth, and William Strange & Company, of Paterson; and that there is no inferiority in machinery or dyeing is testified by the beautful silk-throwing machinery of the Danforth Machine Company and the finely arranged cases of Weidmann & Greppo, dyers of Paterson.» In an appreciative article on the Exhibition, published in the 'Revue des Deux Mondes,' Jules Simonin pointed out the silk industry of America as among the successes with which France would be driven to a closer competition. The Swiss Commissioner-General to the Exhibition called attention, in his official report, to the progress of Americans in silk manufacture and warned his countrymen to be prepared for vigorous rivalry.

The Centennial Exhibition at Philadelphia gave a considerable impulse to the domestic production of «fancies» and Jacquard weaves. Mr. Albert Tilt had prophetically said in a report on

Digitized by Google

Fancies, Scarfs, Handkerchiefs and Tie Silks" to the Silk Association of America in May 1875: "Surely the destiny of American silk manufacturers rests in their own hands."

In 1876 the production of the American silk mills was:

	Value.
Silk dress goods	$ 1,350,535
Millinery and tie silks	1,799,112
Silk handkerchiefs	927,000
Foulards	472,000
Ribbons	4,526,556
Laces	244,500
Sewings and twist	7,252,519
Ladies' dress trimmings, etc	4,278,830
Braids and bindings	315,000
	$21,166,052

Pounds of reeled silk consumed, 1,144,860 (raw silk averaged $9.10 per pound).
Pounds of spun silk consumed, 140,000.

The Tariffs of the United States.—The war tariffs of 1861–4 gave a great impulse to all kinds of manufacturing in the United States, and quite naturally the domestic silk industry was benefitted. The demand for skilled labor attracted a considerable immigration from the manufacturing centres of Europe. The quality of the domestic silk fabrics put on the market was gradually improved. Economies in processes were introduced. Following the commercial and industrial depression which existed in the United States from 1873 to 1878, growing out of the commercial panic of 1873, all textile industries were much vexed by tariff agitations, tariff commissions, and proposed changes of schedules and rates of duty. In 1881, the tendency of fashion veered from brocades and Jacquard weaves to grosgrain, both in broad goods and ribbons. Finally on 1 July 1883, the general rate of duty on silk goods was reduced from 60 to 50 per cent. That year the foreign invoice value of silk manufactures entered at the port of New York amounted to $32,305,236, and for the entire United States $33,307,112. The value of the domestic product amounted to $40,659.64. From 1893–7 there was a space of four years of stress and struggle to the textile industries of the United States, a time when the weak were forced to the wall and the strongest in staying capacity found endurance difficult. Those were years when the law-makers juggled with the tariff and no man could prophesy just what legislation in that regard might happen next. But during the year last named the Dingley Tariff Bill fixed a specific duty averaging 50 per cent on all silk manufactures from abroad, which immediately removed many of the disadvantages endured by the domestic industry since 1883. In 1900 the industry attained to third place in any consideration of textile manufactures in the United States, and to second place among the silk manufacturing countries of the world. It produced in that year:

	Value.
87,636,883 yards of broad silks, plain, fancies, jacquards and piece dyed	$52,152,816
8,970,933 yards of velvets and plushes	4,959,971
1,333,119 yards of upholstery and tapestry stuffs	1,009,835
Ribbons to the value of	18,467,179
1,465,575 pounds of machine twist, sewing, embroidery and wash silks	9,274,800
Gloves, laces, veilings, trimmings and sundries	6,586,611
	$92,451,212

Number of pounds of raw silk consumed	9,760,770
Number of pounds of spun silk consumed	1,774,120
Number of pounds of waste silk consumed	1,667,193
Number of pounds of cotton yarns consumed	6,444,201
Number of pounds of mercerized cotton yarns consumed	219,861
Number of pounds of wool yarns consumed	239,461
Number of pounds of mohair and other yarns consumed	219,254

Modern Silk Machinery and Raw Silk Supplies.—In the past 15 years power-loom weaving has revolutionized most of the processes of silk manufacturing. The changes wrought have brought silk fabrics within the reach of a small purse, and thereby greatly increased the demand on the raw silk producing countries. Changing conditions in the industrial world, which have introduced a vastly greater variety of silk fabrics mixed with cotton and wool fibres, have also added to the demand. The annual raw silk supply of the world has increased 2½ times since 1870; has doubled since 1875; since 1890 it has increased 60 per cent; since 1895 20 per cent. No limit can be placed upon the capacity of Japan and China to produce raw silk provided the demand continues steadily. By close attention to the commercial requirements of her customers in raw silk Japan has very greatly increased her output and export. Her annual shipments of raw silk are now more than five-fold greater than they were in 1870. At that time she shipped abroad 2,000,000 pounds. This year she will ship close to 11,000,000 pounds, and the United States alone will take 60 per cent of it. For the past eight years the American silk manufacturers have received and consumed 60 per cent of Japan's export of raw silk.

From China, the increase is much less marked. In 1870 China exported 6,000,000 pounds of raw silk. In 1899–1900 season, China reached her highest figures of export, namely, 15,000,000 pounds, or an increase of 150 per cent in the 30 years. The best authorities estimate that China now produces annually the equivalent of 250,000 picul bales of raw silk, 55 per cent representing domestic consumption and 45 per cent export. Japan produces the equivalent of 120,000 picul bales, 40 per cent representing domestic consumption and 60 per cent export. Italy produces the equivalent of 75,000 picul bales, 20 per cent representing domestic consumption and 80 per cent export. To represent 1,000,000 kilograms of raw silk reeled in Italy from imported cocoons in 1902–3 season, we must add the equivalent of 15,000 picul bales to the usual output of Italian raw silk in ordinary years. The supply of raw silk to the silk mills of the United States at the present time is approximately as follows in ordinary seasons: From Japan, 50 per cent; China, 25 per cent; Italy, 25 per cent.

Silk is a unique thing because its raw material is produced by the cheapest labor in the world, while its finished product is among the most costly of merchandise.

Making Silk, Past and Present Methods.—A silk mill of the present day would very likely prove a curious and interesting establishment to the pioneers of the industry. As for those first experimenters in the making of the fabric, who crossed from Italy into France during the latter part of the 13th century and labored long for crude results, present methods might suggest even the magic of the magician. It was under the patronage of Louis XI. of France that Guil-

Digitized by Google

laume Brissonet established at Lyons a small factory for the making of silk textile mixed with silver and gold; but nearly a century and a half vanished before any progress in the manufacture was sufficiently pronounced to be recorded. The first looms for "fashioned silk"— figured tissue —were set up in 1605 by Claud Dangon. His loom caused a complete change in the way of manufacture. Following that chronicle comes a brief account about Octavio Mey, a merchant of Lyons, who, one day in the year 1663, put a small bunch of silk threads into his mouth and chewed them. When he took them out he saw that the silk had a lustre. That observation led to the method of giving artificial gloss to the woven cloth. After 81 years more had passed, in 1744, an inventive workman, named Vaucanson, tried to convince his associates that the manual labor given to the loom could be reduced. They destroyed his loom and beat him. Then, as the legend is set down, he invented a machine, for spite, by which a donkey wove a whole piece of silk without the aid of man. But nothing additional has been related of Vaucanson or his work.

JACQUARD.

Not again till 1804, when Charles Marie Jacquard emerged from obscurity and appeared before Napoleon as the man persecuted by his fellow workmen in Lyons, who had invented a contrivance for tying a knot in a taut string, did the progress of silk manufacture become notably evident. Napoleon appreciated the exceptional ingenuity of Jacquard and placed him in charge of the machinery of the *Conservatoire des Arts et Metiers.* It is a pleasing story among many told of Napoleon, and it has been repeated many times. Before the arrival of Jacquard, silk weaving of figured goods was a complicated labor. It had been going on with an infinite display of patience and pains a couple of centuries. Every loom required the attention of at least two workmen; and there was a great deal of mounting and dismounting, screwing and unscrewing, whenever it was necessary to fix or unfix the silk on the frames. The weaving was tedious. Jacquard's loom needed only one man. The handling of the mechanism was sufficiently simplified to make his work easy. It was an appendage to the old loom, or an ordinary loom with a modified harness consisting of a set of strings, one for each of the warp threads, every string suspended from a bearing at the top. A pattern could be worked out by cards pierced with round holes. In the cards lay the greatest part of the ingenuity. It was plain at once that any number of patterns could be produced. With the addition of some minor inventions in other divisions of the industry, the manufacture of silk by hand looms went on the next half century without any improvement which created any radical change. The application of water and steam power to the loom was the next advance.

A SILK MILL IN THE 20TH CENTURY.

The silk mill of the present day, completely equipped, presents an interesting appearance. The largest of these in the United States are in New Jersey, Pennsylvania, Connecticut, Massachusetts, Michigan, and New York. Some of these mills, with their collateral buildings, form quadrangles and groups that compose an industrial community. There are seven separate divisions in the silk manufacture — throwing, dyeing in the skein, winding, weaving, dyeing in the piece, printing and finishing. A few exceptional plants include the entire process. Raw silk has a yellow or white color. It is reeled from the cocoon in skeins. Any visitor on a tour of observation in the mills would be shown this supply first packed in the storage house. The several departments of the establishment are devoted to the throwing, preparing and weaving. The dyeing, printing and finishing departments are often separate buildings. Any one whose interest can be stimulated by ingenious achievement will find the process of creating silk fabrics attractive from the beginning. Brought from the storage house the raw silk is given to the throwster. It being in a condition too fine and delicate for ordinary use, there is necessity to subject it to a series of operations called throwing — that is, winding, cleaning, doubling, twisting, re-winding and reeling the raw into more substantial yarn. The operator who does this is called a throwster, the dictionary makers say, because of the old Saxon expression *thrawan*, meaning to twist. The silk when thus treated is named, according to the several purposes for which it is designed, singles, tram and organzine. The first is made by giving the single thread a twist to give it strength and firmness. The second consists of two or more threads thrown just sufficiently together to hold, by a twist of one or more turns to the inch. The degree of twist varies according to the special article proposed to be made. Organzine is formed of two or more singles, according to the thickness required, twisted together usually in a contrary direction to that of the singles of which it is composed.

Sewing-silk and machine twist is likewise manufactured complete in the gum; sewing silk being made from two strands and machine twist from three. The last process before reeling is stretching. The stretching machine is an American invention of great value to sewing silk manufacturers. This is used to even up the thread and to give it firmness and uniformity in size, the operation tending to draw down the looser and thicker portions to the same diameter as the thinner ones. Singles, tram, organzine, sewing-silk and machine twist are then transferred to a reel and made into skeins preparatory for the dyer.

The dyer boils the skeins in soap and water to free them from any remaining gum and to give the desired softness and lustre. This takes away from the silk from 20 to 30 per cent of its original weight, leaving it on an average 12 ounces to the pound. Next it is put into the dye vat; and the dyer may or may not, by use of metallic substances in the dye, make the silk appear heavier and thicker and stronger than it naturally would be. By general consent black or dark-colored silk is allowed to be weighted sufficient to make up partly the loss in boiling. Light colors do not bear so much weighting. Most of them, in fact, admit of no adulteration. It injures and weakens the texture. Any silk, if heavily loaded, will break easily, feel rough to the touch because of the particles of the dye, and burn smolderingly into a yellow, greasy ash, instead of a crisp cinder.

Digitized by Google

Following the dyeing comes the process of winding the silk on spools, work requiring much skill and care, as it is in a condition known as soft silk. The operatives who perform this work are a separate class, soft-silk winders. Sewing-silk and machine twist are spooled or skeined preparatory for the market either on small spools, or if embroidery silks, in skeins. When dyed silk leaves the hands of the "soft-silk winder" it is ready for weaving broad goods, ribbons, braids, laces, sashes, handkerchiefs, etc. In any woven fabric there are two systems of threads, the warp or chain running lengthwise in the cloth, and the filling or woof crossing the former at right angles. This crossing, or interlacing, consists of every warp thread being placed alternately under and over one or more threads of the filling system. The arrangement of this interlacing is technically called the weave, and the variety in which the points of crossing can be distributed appears to be without limit. It is chiefly the weave which gives to a fabric its character, in connection with the material used, the tension of the threads and the combination of colors.

FOUNDATION WEAVES.

There are three foundation weaves. They are designated as taffeta, serge and satin. In the foundation weaves each thread effects only one crossing in one repeat of the weave, and the points of the interlacing occur in a given rotation. A repeat in the foundation weaves comprises the same number of warp-threads as of picks or filling threads; and if this number be eight, for instance, the weave is called an eight-shaft or an eight-harness weave.

In the old heavily built and complicated looms, the repeat was limited to twelve shafts and twelve picks, but modern looms are of much lighter make and simpler construction. A repeat of 25 shafts can now be made, while in the filling it is almost unlimited.

There are also two additional and entirely different weaves, namely, gauze and velvet weaves. Velvet weave is described below. In gauze weaves, the threads work in groups of two sets. One set continuously remains below the filling; the other is alternately raised on the right and left sides of the first, and is therefore always above the filling. In this manner, a crossing is made, which holds the filling in place.

To begin with, a warp must be constructed, and this is usually made of organzine, but can be made of single thread or tram. Those engaged in that labor, usually women — will be found, perhaps, in one of the upper lofts of the mill. It is one of the quiet processes, cleanly, and though not particularly difficult is considered one of the most important in successful silk manufacturing. The yarn having been transferred from the skeins to bobbins, these are set in a frame from which the warp-machine is to be fed. At best the mere written description of any mechanical process can only prove more or less vague. It needs the eye to reveal it. But it may be said that this contrivance on which the warp is arranged would have the appearance, to the casual observer, of an upright frame girded with long, white strings. It is about a yard in width. Two women sit before it and draw the silken threads between the cords. They are strung over a sheet a couple of yards or more to an opposite frame, similar in appearance to the first mentioned, where two more women receive them and drawn them taut. As the warp is fastened it is drawn forward around a cylinder. This warp, when put on the loom by a drawer-in, is ready for the weaving, whether it be plain, or as satin or velvet, twilled on one side, or in figures introduced by means of the Jacquard harness. The winding of the woof, or the filling, is accomplished by winding from the spool or bobbin to a smaller spool called a quill on a quilling frame. The quill fits into the shuttle which conveys the thread across the warp.

LOOM AND HARNESS.

The modern power loom is a strong iron frame, at the back of which is the horizontal beam or roller from which the warp unwinds, and at the front the roller on which the web is wound as it is made. Between the two is the harness, which is a series of frames with eyelets, one for every thread, or set of threads, of the warp. In plain weaving the harness frames are in two sets, of three frames each, one set of which is up while the other is down. The number can be increased to several frames, all acting independent of one another, for complicated patterns; and in the Jacquard loom the harness becomes a set of strings instead of a frame, so that every thread of the warp can be raised or lowered separately. Between the beam and the harness is the reed, through which the warp threads pass to the take-up roller in front of the loom, and between the harness and the web roller, the shuttle and the batten. As the machine revolves the warp threads passing from the beam through the reed, are lifted or depressed by the harness; in the opening made by such lifting or depressing, the shuttle flies across the warp, and the batten beats up the thread it leaves, and a new woof is added to the fabric. The complications of the fabrication reveal themselves as soon as the power is turned on and the actual web begins to appear, close, compact and delicate. In high-grade Jacquard work the back of the weave is uppermost, and moment after moment it steadily increases as if by magic. It is the rich and costly fabric coming into view for which the worm spun its cocoon many months previously in Japan, China or Italy. An energetic weaver on a power loom can turn out from 10 to 20 yards a day — that is, a day of 10 hours' labor.

CHANGE OF WEAVE.

Attention may be directed to the fact that there are other ways of varying the weave. In satin, for instance, the result is attained by throwing the warp mostly to the upper surface. As the organzine, or warp silk, is the most lustrous, the satiny effect is produced. Gros grain is made by plain weaving, half up and half down, with a woof of a thickness to correspond with the rib or grain. Stripes, if in the length, are produced by warp threads of different colors; if in the width, by feeding the woof from shuttles carrying different colors of thread, each of which, by an automatic device, is lifted into position to be thrown at the proper moment; and plaids by making both warp and woof threads of different colors.

Digitized by Google

VELVETS.

Velvet is made in two ways, that of the finest grade being woven by looping the warp thread over fine wires, which give, by their size, the desired length of pile. When the weaver has made a few inches of web requiring several hundreds of these wires, he stops the loom and runs a knife along each of these wires, guided by a groove in its upper surface. The other system is that made possible by the power loom for the production of pile fabrics. In this two cloths are woven together, the pile binding the two until a knife, working like a shuttle, cuts them apart. Velvets are brushed, sheared, and ironed to the finest possible degree of evenness. It should have been stated also in regard to broad silk that after it leaves the loom it passes to workwomen, who pick it over, yard by yard, for knots in the weave and to discover any imperfections. These are remedied, and wherever the silk may have been soiled it is cleaned. Then it is sent to the finishing room. It is there treated with different processes, according to the special characteristics desired, as high lustre, hard or soft touch, etc. If, however, the silk is not yarn-dyed, it goes from the loom to be piece-dyed in any shade desired, or to be printed. Like calico, it is printed on a machine having a roller for each color.

THE RESULT.

Finally the total result comes to the superintendent of the mill for inspection. He considers it critically, for the reputation of the establishment, in competition with the numerous other mills, depends on the quality of the silk he can produce. These men are experts, and they give as much time to the acquiring of an education in the textile schools of France, Switzerland and Germany as a lawyer or physician does qualifying himself to practise. At Lyons, Zürich and Crefeld they are taught silk-weaving as one of the fine arts. It is they who provide much of the instruction now which is given in the American mills. There are, however, textile schools of recent origin at Paterson and Philadelphia for instruction in silk weaving. The Philadelphia Textile School instruction includes the designing, warping, weaving, dyeing, analysis, etc., the practical portion of the instruction being facilitated by an equipment of the most up-to-date machinery. The self-reliance and courage so characteristic of Americans in producing successful results in the industrial and commercial progress of the country are characteristic also of the operatives and workers in the mills. The American system of education which for the most part is absolutely without any charge to the boys and girls develops keenness of intellect, habits of thought, enterprise and knowledge which are of great service to them in whatever employment they enter. This is an element of strength to the country which competing nations will have to face more and more in the future. Trained and educated men, even from the highest colleges and universities, are more and more devoting themselves to the industrial arts and to transportation and commercial problems, the practical effect being the cheapening of transportation, economies in cost of production, and therefore lower prices to consumers.

For the most part the American manufacturer of broad silk uses only the best quality of the raw material, and usually only coarse sizes. In this respect he differs noticeably from the European manufacturer. His aim, besides perfection in his goods and small waste of materials, is the gaining of the best results from the looms in yardage. A high yardage reduces the average of wages and general expenses. Low grades and fine sizes are better suited for hand looms and are, therefore, not much used by silk manufacturers in the United States. Notice should be taken also that it is essential for those in control of these mills to study assiduously the trend of style and fashion. Versatility is a decided necessity in the capacity of a plant. It has been remarked by an experienced observer that it is astonishing to note the facility with which the American mill changes from light to heavy, from simple to complicated, from plain to faconné goods, and from yarn- to piece-dyed weaves. One of the important factors that contributes to the energy which endeavors to rise equal to any occasion is the simplicity of the American machinery. It is agreed that it enables an ordinary weaver to do work which in foreign mills can be accomplished only by the most skilled and experienced. In the United States there has never been any suspension in the endeavor to keep foremost in new mechanical introductions. Antiquated and worn-out equipment have been replaced always by the modern and more economical, the constant effort being to reduce the cost of production.

THROWING PLANTS.

Some of the American improvements made within the past decade should include the success in perfecting the winding frame in throwing, so as to produce more perfectly wound spools at high speed and obviate the necessity for redrawing. In the latest improved frame the bobbin is carried by a spindle having two heads resting on the driving wheels, its bearings being supported upon inclined planes that sustain most of the weight, yet force the spindle into sufficient contact with the friction wheel to secure a positive drive, the double support allowing high speed without throwing out the spindle. Double decking the winding frame has also been adopted by some to economize space. The doubling frame has been perfected sufficiently to permit work to be done at double speed of heretofore, and with better results. The old "flyer" and "jack-pin" system has been partially displaced by a cap on the bobbin, by means of which the thread can be drawn off naturally and the desired tension applied on the assembled threads. In spinning, the Continental belt system, so called, where the spindles are driven by contact with an endless belt instead of by bands, has been adopted in all new installations. More than one half of all the spinning spindles in the American mills are of this system, although only first introduced in 1889. A double-deck machine of this type, giving double the number of spindles in the same space, still further solved the problem of economy of space. In 1895 a combined spinner and doubler was designed that has resulted in being largely adopted, not only in the United States, but in several foreign countries, and in the technical schools of England and Switzerland. An effort to solve the problem of spinning, doubling and twisting organzine in one process has resulted in the production of practical machines of

Digitized by Google

both belt-driven and the old band-drive system. The improvements in throwing machinery during the past 20 years are estimated to save about 40 per cent in floor space and 20 per cent in the cost of throwing.

BROAD WEAVES — POWER LOOMS AND HAND LOOMS.

In weaving perhaps there has been more progress in improved machinery the last decade than in the three preceding decades. The improvements have produced a loom of very high efficiency, equipped with mechanical devices designed for saving time, labor and material, such as numerous multipliers, two-weave, leno, swivel, embroidery motions, and many others all arranged to work automatically. Special mention should be made of the improvements by which all classes of taffeta effects, formerly made on hand looms only, are now made on power looms. In the Jacquard loom there has been so many improvements the last 10 years that it has become almost a new loom. This is specially noticeable in the saving of cards and the increase of speed. Attachments have been added which dispense with the pattern or box chain on the loom, the cards being so punched that the shuttle boxes are controlled by the Jacquard.

While the hand loom is no longer a factor of importance in broad silk weaving in the United States, nevertheless it remains a very considerable factor in Europe and the countries of lower wages. In 1900 there were 97,445 hand looms, available for silk weaving in France, Germany, Switzerland, and Italy, as against 61,957 silk power looms in the same countries. Hand looms do not require so much capital to install and operate. They are much less expensive in construction; when idle, the interest and general expense account running against them is small, and production is therefore readily stopped without loss. It represents a household industry in the main, and quite the reverse of the factory or mill system which has been described. The greatest perfection in weaving is also obtainable on the hand loom on account of the slower production. There are two commercial reasons, also, why hand looms continue in such considerable use, despite the perfection which power loom weaving has attained.

1. The possibility of using finer sizes and cheaper grades of silk. The more uneven and less elastic raw silks and the inferior grades of waste silk bring a lower price than the better grades, and require a slower manipulation than is possible on the power loom. With low wages for labor, and every item of cost of production lessened, a profit is reached which vanishes when higher priced labor undertakes to do the same thing. Europe has always had a monopoly of the cheapest goods and the highest priced goods.

2. The highest class and most expensive productions known to the industry are possible only on the hand loom. Weaves of highly complicated design, and great variety of materials, require very slow production and the most skilful operatives. Some fabrics are limited to one or two yards production per day, and some weaves employ 10 to 20 colors in the filling. Their cost may range from $4 to $10 per yard. France, and especially Lyons, has always been renowned for these productions. Among these high grade specialties may be named:

Furniture coverings, tapestries and curtains,
Church vestments and altar cloths,
Fabrics intermixed with gold and silver,
Broche velvets, laces and novelties of every kind.

In other words these Lyons productions fill the gap between the power-looms and the Gobelin tapestries.

There is also the power driven hand loom called the French loom, but there are not many of these looms in the United States, and not many now in use in Switzerland or in France. The regular power loom known as the crank loom has largely supplanted them. In the French loom the lay swings from the top of the loom; is moved backward by an eccentric, but falls forward by its own weight; in so doing the pick is beaten up with a short quick stroke. On the crank loom the lay revolves on a shaft at the bottom of the loom; it is moved back and forth by a crank and the pick is pressed into the cloth.

RIBBONS.

Many changes have also come to pass in the development of the ribbon loom. These are now capable of high speed and show a great advance over the Swiss and German types, which were the ribbon looms principally in use ten years ago. The modern ribbon loom was first designed in the United States. Under the old methods of handling the warp it was necessary to employ men on the looms. At present the warp is placed on beams similar to broad-silk looms, and every warp is let off automatically from each beam, making it unnecessary for the weaver to go behind the looms for this purpose. The best type of ribbon loom, the high-speed automatic, includes all the latest improvements of construction. It is adapted to high-grade Jacquard work, where high speed has been slow of adoption. It has the automatic let-off system for the warps, is capable of a more uniform weave than the old machine and has greater productive capacity. Attention may be directed also to a very efficient silk-velvet ribbon loom that has recently come into use. Incidentally, it may be mentioned that nowhere has inventive genius, in connection with the power loom, been so notable as in the United States. The most pronounced features of American power looms are light construction, ease in handling, simplicity in operation, accuracy of weave, and moderate cost.

The total weekly labor in an American silk mill is usually 58 hours, although the legal time allowed by factory laws varies in different States.

The End of the Century.—Looking back 50 years at the end of the century the notable fact is apparent that the value of American products in silk in 1900 was nearly 60 times as great as in 1850. The American manufacturer had arrived at a period in which the importation was confined almost wholly to the costliest fabrics in broad silks, the fashionable novelties, church vestments and specialties not suitable for mechanical weaving. The industry had spread from New England and the Middle States into many other States, although the comparative rank in importance was as follows: New Jersey, Pennsylvania, New York, Connecticut, and Massachusetts. Those States had respectively 180, 121, 92, 38, and 20 silk manufactories. The greatest growth was noticeable in Pennsylvania.

Digitized by Google

20 years previously the silk industry in that portion of our country was scarcely apparent. Between 1880 and 1890, in Pennsylvania alone, "throwing" plants at first and weaving plants later, were established in 18 separate towns or places where previously there had been none. The incentive was cheaper fuel, cheaper wages, lower taxes, less cost for factory space, etc.

During the last decade the silk industry of the United States reached the point where its future seemed assured as a permanent branch of the textile industries of the country. American manufacturers had shown their ability to meet the exacting demands of consumers by producing nearly all descriptions of weaves known to the trade. Silk mills were erected at many new points in this decade, 52 being located in Pennsylvania, 14 in New York, 10 in New Jersey, four in Connecticut, four in New Hampshire, three in Rhode Island, two each in Delaware, Maryland, Virginia and North Carolina, and one each in Michigan, Ohio, Illinois and Wisconsin, aggregating 99 separate places where silk mills were put in operation in the 10 years.

Power loom weaving and ingenious mechanicians combined have revolutionized nearly all the processes of the manufacture. The accompanying statistical tables illustrate the great changes that have taken place in mechanical equipment in different countries in recent years.

The United States have been a leading factor in the development, and especially so in the past five years. If the present fiscal policy of the Republic endures, the United States will soon take first rank in its annual output of silk products. It now holds second place, France being first in value of annual production. The supremacy of the United States as an industrial nation means lower prices to consumers, and consequently a much wider distribution of products than ever before. When this can truthfully be said of articles of adornment and art, as of silk goods, every American can take pride in the industrial and commercial achievement.

The tables following indicate in figures the comparative growth of the silk industry in the United States, 1875–1900, (1) by loom equipment, (2) description of production, etc. A comprehensive view of the world's silk industry and its production of raw silk is presented in this encyclopedia under the title World's Silk Industry.

TABLE I.—POWER LOOMS AND HAND LOOMS IN UNITED STATES OF AMERICA.

Year	Power looms			Hand looms		
	Broad goods	Narrow fabrics	Total	Broad goods	Narrow fabrics	Total
1874	1,189	888	2,077	779	728	1,507
1875	1,428	1,260	2,688	1,005	809	1,814
1880	3,103	2,218	5,321	1,629	1,524	3,153
1890	14,866	5,956	20,822	413	1,334	1,747
1900	36,825	7,432	44,257	164	9	173
1902	44,000	8,000	52,000	Practically none		

Prior to 1900 the silk trimmings industry gave employment to a considerable number of looms, both power and hand, and these are included in the foregoing figures.

TABLE II.—COMPARATIVE GROWTH OF THE SILK INDUSTRY OF THE UNITED STATES.

The figures for 1880–1900 are United States census returns for those years.

Production	1875	1880	1890	1900
Piece goods	*$5,446,329	$11,224,895	$22,955,750	$52,152,816
Ribbons	4,815,485	6,023,100	17,081,447	18,467,179
Laces	199,652	437,000	261,750	803,104
Braids and bindings	383,100	999,685	2,771,382	1,522,565
Trimmings, etc.	3,961,114	8,306,520	8,554,566	2,295,010
Sewings and twist	6,420,833	6,783,855	7,068,213	9,274,800
Other products	....	744,668	2,542,625	1,965,932
Velvets and plushes	....	....	3,141,026	4,959,971
Tapestries and upholstery stuffs	....	....	3,712,332	1,009,835
Hosiery and knit goods	....	....	1,065,508	....
Total	$21,226,513	$34,519,723	$69,154,599	$92,451,212

* Strictly dress goods in 1875 were $1,412,500 only. The balance were millinery and tie silks, scarfs, handkerchiefs and foulards.

	1875	1880	1890	1900
Number of throwing spindles	168,843	262,312	718,360	1,045,304
Spun silk consumed, pounds	150,000	*a*	*a*	1,550,291
Raw silk consumed, pounds	1,275,872	2,690,482	6,376,881	9,760,770
Yarns other than silk, pounds	*a*	*a*	5,624,960	7,116,728
Consumed in sewings and twist, pounds	544,470	791,525	1,119,825	1,465,575
Number of operatives	18,017	31,337	49,382	65,416
Wages paid	$6,392,256	$9,146,705	$17,762,441	$20,982,194
Capital invested	$17,913,858	$19,125,300	$51,007,537	$81,082,201

a indicates "not reported."

Franklin Allen, C.P.A.,
Secretary Silk Association of America.

Digitized by Google

Silk-cotton Trees, any one of the trees belonging to several tropical genera of the *Malvaceæ,* as *Bombax, Eriodendron, Ochrona,* and *Pachira.* They are usually large trees, the greater number native to South America, with handsome mallow-like flowers, light, soft wood, and bark containing bast fibres used for cordage. Those species most entitled to the name are *Bombax malabaricum* of the East Indies, and *Eriodendron anfractuosum,* of both the Oriental and American tropics. The latter, the silk-cotton tree of the West Indies, is one of the most abundant and largest trees of the Antillean forests, and is either low-branched or tall with naked trunk and massive crown lifted high above the other trees. When young its trunk and branches are covered with sharp spines, which afterward disappear. The bark is hard, clean, and white, surrounding a pulpy interior. The trunk is sometimes 100 feet high, and in well-grown specimens is without branches for the lower part; but as the tree ages the trunk enlarges near the ground, being sometimes 12 feet in diameter, and great buttresses, tall and thin, spring from it on all sides and run out in an undulating fashion, for perhaps more than 100 feet along the surface of the ground, before finally penetrating the soil and anchoring the tree. These braces are invaluable for bracing the tree against heavy winds. The leaves are glossy, dark green, and deciduous. The yellow flowers appear just before the leaves and are followed by great pods whose valves burst open when mature, causing the tree to seem smothered in glistening white thistle down. This is because the seeds are wholly invested in delicate cotton-like fibres, and being very light are carried off by the wind for long distances. Unfortunately, although closely allied to the cotton plant (*Gossypium*) these fibres are too short to be woven into textiles; but those of one silk-cotton tree, *Eriodendron anfractuosum,* are employed for stuffing cushions and other upholstery, and are an important article of trade, the principal source of supply being Java. This species is found both in southern Asia and in tropical America, and is a tree from 50 to 100 feet high, with palmate leaves and showy flowers. Its seeds are eaten in some Pacific islands. *Ochroma lagopus* is also called down-tree, or cork-wood, on account of its light porous wood.

Silk Weed. See ASCLEPIAS.

Silkworm-gut, a substance prepared from the silky secretion of the caterpillars of the ordinary silkworm taken from the insects' body, and constituting the lustrous and strong line so well known to anglers under the name of "gut."

Silkworms, entomologically, any caterpillar which spins a cocoon of silky fibre; popularly, the various species which yield a fibre used commercially. All are caterpillars of moths, and feed upon foliage of various trees and shrubs. Among the less important species the following are probably best known: The Japanese oak-feeding silk-moth (*Bombyx yamamai*) is noted for its green-tinted silk, which is used in Japan and China for embroidery; a close relative (*B. peryni*), also an oak-feeding insect, is a native of northern China, where its large grayish-brown cocoons are used to a considerable extent for threads and various fabrics. The Chinese also use the gray silk of an allied species (*B. cynthia*), which feeds on the tree of heaven (*Ailanthus glandulosa*), for the manufacture of a soft fabric. Since the thread cannot be reeled the silk is obtained by carding methods. So far as known these species have not been extensively employed commercially except in the Orient, though they have been used tentatively in France and other silk-manufacturing countries. The tussur or tusseh moth (*Antheræa paphia*) spins a hard grayish-white cocoon from which the natives of India, where the species is indigenous, manufacture tussur silk. The Bengalese use the pure white silk of the boro poloo (*Bombyx textor*) and the yellow silk of the dasee-worm (*B. fortunatus*) for making a silk cloth which rarely reaches the world's markets because of its inferior quality. Several North and South American species yield silk which has not become commercially important. Of these the best known are probably the cecropia (*Platysamia cecropia*) and the polyphemus (*Telea polyphemus*). The amount of silk they produce is far greater and stronger than is produced by the Chinese silkworm, but the thread cannot be reeled without difficulty.

The most important and most widely disseminated species of silkworm is *Bombyx mori,* a native either of northern China or of Bengal. It seems to have been domesticated at a very early date, which is placed by Chinese authorities at 2600 B.C., when the wife of Emperor Hoang-ti commenced feeding the caterpillars. In 552, two monks brought eggs to Constantinople, superintended experiments in cultivating the worms, and turned the industry over to the Emperor Justinian by whom it was monopolized. Neighboring peoples soon took it up, however; and now many countries, especially those of the Mediterranean region, Persia, India, and Arabia, raise silk in commercial quantities.

The silkworm is the larva of a large moth with a short thick body, stout legs, and broad white wings crossed by several black lines or by a pale brown bar upon the anterior pair. In early summer the females lay from 200 to 500 bluish eggs, about as large as a pin's head, singly upon any convenient surface, gluing them there by a mucilaginous secretion, silky when dry. These do not hatch until the following spring. Then the larvæ, about one quarter of an inch long and yellowish-gray or brownish, commence to feed, and soon consume about their own weight of foliage daily and increase rapidly in size. When about 10 days old they become lethargic and stop eating until after they have cast their skins. In this operation the old skin bursts near the front and the caterpillar squirms itself out, leaving the old skin attached to the branch or leaf upon which it was stationed. The worms rapidly increase in size immediately after the molt, then steadily diminish as the time for the next molt approaches. The process is performed four times before the caterpillar spins its cocoon, which it does when about six weeks old. At this time it is about three inches long and half an inch in diameter, has 12 visible body segments, three pairs of true legs and five pairs of pro-legs. It now ceases to feed, empties its alimentary tract, and seems to shrink in size. The spinning then commences, the insect making first an outer

Digitized by Google

network known as the "floss," and then winding the silk in a continuous thread around its body which continues to decrease in size; indeed, the completed cocoon is considerably shorter than the caterpillar itself, being only about 1½ inches long. The operation of spinning occupies about five days, during which time the insect usually produces from 2,000 to 3,000 feet of silk, which, when microscopically examined, is seen to consist of two blended strands. These are produced by special glands (sericteria) which extend nearly the whole length of the body and terminate in apertures (spinnerets) situated in the mouth. In from 15 to 20 days after the chrysalis has been formed the adult insect emerges, lays its eggs and dies. It has been estimated that there are about 20,000 to 40,000 eggs, popularly known as "seed" in an ounce; about one ounce of eggs will yield 100 pounds of cocoons or nine pounds of raw silk; from 15 to 20 pounds of good mulberry leaves should yield one pound of cocoons; and well grown mulberry trees should yield about 100 pounds of leaves. The amount of space allowed for the caterpillars produced from an ounce of eggs varies from one square yard, immediately after hatching, to about 64 square yards when spinning time arrives — each change being double the previous space: 2, 4, 8, 16, and 32.

The food of the caterpillars is preferably the foliage of the white mulberry tree (*Morus alba*), but several other species are employed, notably the Japanese mulberry (*M. japonica*), the alpine mulberry, (*M. alpina*), and *M. multicaulis* and *M. moretti*. The osage orange (q.v.) is occasionally used as a substitute, but is said to produce an inferior grade of silk. The black mulberry (*M. nigra*) is objectionable because slow in growth. The caterpillars also thrive upon the leaves of lettuce and some other plants.

In the cultivation of the silkworm the first requisite is an ample supply of foliage. This is usually obtained by growing the mulberry trees far enough apart to give each ample room to develop its branches in all directions, the distance varying from 15 to 40 feet depending upon the variety, method of training, etc. Frequently the trees are treated much the same as in pollarding (q.v.), except that the branches are cut while small. The eggs having been kept over winter at a temperature of less than 50° F. in a dry circulating atmosphere, are placed in a room or an incubator in which the temperature is raised gradually to about 73°. In about 10 days the larvæ emerge and are covered with sheets of perforated paper sprinkled with chopped mulberry leaves, which should be renewed about nine times during the first 24 hours, each time by placing a fresh paper above the soiled one, which should be burned. Paper with larger perforations is necessary as the worms grow. As they approach maturity their appetites become voracious. When ready to spin they should be supplied with brush, straw or other material upon which to form their cocoons and the temperature at this time should be kept about 75° and the humidity close to 65°. At all times scrupulous cleanliness is essential, as also is abundant fresh air. When spinning is completed, no sound is heard inside the cocoon. The cocoons are then sorted according to quality, size, and color into nine grades for manufacture, a separate lot being selected for breeding. The sexes are readily recognized, the males being smaller and their cocoons having more pointed ends than those of the females. After grading they are heated to destroy the insects within, whose emergence, if left alive, would break the thread many times. The manufacturing process is then commenced.

Where a uniform and favorable temperature are not maintained, where humidity and purity of the air are impaired, and still more where there is deviation from the strictest cleanliness, silk growers have often experienced serious losses of their caterpillars at all stages of their growth. Purifying the breeding and feeding quarters after each "crop," and again before the introduction of a new one, are essential. The walls are whitewashed, the trays sterilized in various ways, and the apartments fumigated with burning sulphur. No detail that will insure cleanliness throughout the feeding period must be neglected, else the worms may suffer from the diseases which follow in the wake of neglect. Four of these, called in France pebrine, muscardine, gattine, and flacherie, are due to infectious organisms; for a fifth disease, grasserie, no ascribable cause has been discovered. Pebrine devastated France to such an extent that by 1847 eggs were all imported from Italy. By 1865 the only safe source of egg-supply was Japan. Pasteur showed that rational methods of cleanliness in the breeding and feeding were the only remedy; the result is that France exports about 10 tons of eggs annually.

Consult: Kelly, 'Culture of Mulberry Silkworm,' Bulletin 39, Division of Entomology, United States Department of Agriculture (Washington 1903; Bulletin 9); Villon, 'La Soie' (Paris 1890); Verson and Quajat, 'Il filugello e l'arte sericola' (Padua 1896).

Sill, Edward Rowland, American scholar and poet: b. Windsor, Conn., 29 April 1841; d. Cleveland Falls, Ohio, 27 Feb. 1887. He was graduated from Yale in 1861, entered business in California, but returned to the East, and studied at the Harvard Divinity School. His views toward the ministry, however, he soon abandoned; and he became literary critic on the staff of the New York *Evening Mail*. Thence he went to Ohio, where he did some teaching, and to California, where he was made principal of the Oakland high-school (1871) and professor of English literature in the University of California. In 1883 he returned to Ohio to devote himself wholly to literary work. Sill did not write readily, nor willingly collect what he had at intervals printed in magazines, particularly the 'Atlantic.' He won, nevertheless, a recognition which, if not general, is ample, and a just tribute to real gifts. He wrote with a certain terse austerity not, as has been pointed out, unlike Emerson. Indeed he was, in thought and manner, a later transcendentalist. One of his poems, 'The Fool's Prayer,' is the property of every anthology. The posthumous selection, 'Poems' (1888), contains his best. 'Hermione, and Other Poems' appeared in 1899, and in 1900 'The Prose of Edward Rowland Sill, with an Introduction Comprising Some Familiar Letters.'

Sill, Joshua Woodrow, American general: b. Chilicothe, Ohio, 6 Dec. 1831; d. Murfreesboro, Tenn., 31 Dec. 1862. He was graduated

Digitized by Google

from the United States Military Academy in 1853, and was soon called to the Academy as assistant professor of ethics, geography, and history. He resigned from the army in 1861 and became professor of civil engineering and mathematics in the Brooklyn Polytechnic Institute. He commanded a division of the Army of Ohio in 1862, and was killed while leading his brigade at the battle of Murfreesboro.

Silliman, sĭl'ĭ-man, **Benjamin**, American scientist: b. North Stratford, Conn., 8 Aug. 1779; d. New Haven, Conn., 24 Nov. 1864. He was graduated from Yale in 1796, studied law, and was admitted to the bar in 1802, but accepted the chair of chemistry and natural history at Yale in 1802. He went abroad in 1805 to continue his studies, and while in Edinburgh became interested in geology. On his return home he made a geological survey of a part of Connecticut, the first survey of the kind made in the United States, and in 1807 published an account of the celebrated Weston meteorite of 14 Dec. 1807. In 1811 he began a series of experiments with the compound blow-pipe, obtained for the first time in the United States the metals sodium and potassium, and discovered in 1822 the fusion of the carbons in the voltaic arc. He founded the ‹American Journal of Science› in 1818, acting as its sole editor until 1838, and as senior editor until 1846, opened the Lowell Institute in Boston with a series of lectures on geology in 1838, and in 1840 was elected president of the American Association of Geologists. He resigned his chair at Yale in 1853 and was made professor emeritus, but continued to lecture until 1855 when he retired. He was named by Congress for one of the original members of the National Academy of Sciences in 1863. His publications include: ‹Journal of Travels in England› (1810); ‹Elements of Chemistry› (1829); ‹Consistency of Discoveries of Modern Geology with the Sacred History of the Creation and the Deluge› (1837); ‹Narration of a visit to Europe in 1851› (1854); etc. Consult Fisher, ‹Life of Benjamin Silliman› (1866).

Silliman, Benjamin, American chemist, son of the preceding: b. New Haven, Conn., 4 Dec. 1816; d. there 14 Jan. 1885. He was graduated from Yale in 1837, and in 1838 became instructor in chemistry, mineralogy, and geology at Yale, was appointed professor of applied chemistry in 1846, and in 1854 succeeded his father in the chair of chemistry, a position he occupied until his death. He was one of the founders in 1847 of the Yale Scientific School, and was professor of medical chemistry and toxicology in the University of Louisville, Ky., in 1849–54. He was in charge of the departments of chemistry, mineralogy, and geology at the World's Fair in New York in 1853, was elected one of the original members of the National Academy of Sciences in 1863, and in 1869 became one of the state chemists of Connecticut. He published: ‹First Principles of Chemistry› (1846); ‹Principles of Physics› (1854); ‹American Contributions to Chemistry› (1875); etc.

Sillimanite, a mineral occurring in long slender crystals, and fibrous masses, and composed of silicate of aluminium (silica 36.9, alumina 63.1 = 100). Its crystals belong to the orthorhombic system; its hardness varies from 6 to 7 and its specific gravity from 3.2 to 3.3. The color is various shades of brown, or gray, or greenish. The streak is uncolored, and the mineral varies from transparent to translucent. It occurs in gneiss, mica schist, and other metamorphic rocks, in Massachusetts, Connecticut, New York, Pennsylvania, Delaware, North Carolina, etc. The name was given in honor of Professor Silliman of New Haven.

Siloam, sĭ-lō'am, or **Siloah**, sĭ-lō'a, a pool or tank in Jerusalem, fed by the waters of Gihon and forming part of the ancient water-supply system of the city: a tunnel leads to the pool from the «fountain of the Virgin.» In 1880 some boys playing in the pool crawled into this ancient tunnel, and one of them noticed a tablet bearing an inscription. That inscription, as deciphered by scholars in 1881, tells of errors of measurement committed by the miners and how they were corrected. In places the inscription is undecipherable, but, line for line, it is rendered thus:

1. Lo the tunnel. Now this is the history of the tunnel. While yet the miners were plying
2. The pick, each toward his fellow and while there were yet three cubits to be cut, there was heard the voice of a man.
3. Calling to his fellow, for there was a *misdirection** in the rock on the right hand . . . and on the day
4. Of tunneling through, the cutters smote pick against pick, and there flowed
5. The water from the channel to the pool, 12,000 cubits, and . . .
6. Cubits was the height of the rock above the excavators' heads.

*Conjectural.

Silures, sĭl'ū-rēz, the name of an ancient British tribe which inhabited the district included in the modern counties of Hereford, Radnor, Brecknock, Monmouth, and Glamorgan. They were of the earlier Celtic stock, and were among the most warlike of the British tribes. They were subdued by the Romans about 78 A.D.

Silurian or **Siluric System**, a term applied in 1835 by Sir Roderick Murchison, director-general of the Geological Survey of Great Britain, to those rocks of South Wales (the country of the old Silures), which were formerly included as «grauwacke» in the Transition System of rocks. In the typical region the rocks are divided as follows:

		Approx. average thickness. Feet.
Upper Silurian	6. Ludlow Group	1,900
	5. Wenlock Group	1,600
	4. Llandovery Group	3,000
Lower Silurian	3. Bala and Caradoc Group	6,000
	2. Llandeilo Group	3,000
	1. Arenig Group	4,000
		19,500

While Murchison was studying these strata in South Wales, the renowned Adam Sedgwick studied the rocks of North Wales, making out their true succession, and naming them «Cambrian,» from the ancient name of the district, Cambria. These were also divided into an upper and lower division, and as the study continued year after year, higher and higher strata were added to the top of the Cambrian series. Likewise, in the study of the Silurian strata, Murchison included lower and lower strata, and thus the two systems overlapped. It finally appeared that Murchison's Lower Silurian and Sedgwick's Upper Cambrian were equivalents, and this gave

Digitized by Google

rise to a long controversy as to the use of the proper term. This controversy outlived the two principals, and has only recently been settled by the adoption of Lapworth's name «Ordovician» for the middle series. Thus the term Siluric or Silurian is restricted to-day by most geologists to the Upper Silurian of Murchison.

In North America the following subdivisions are recognized:

Upper Siluric or Cayugan group.
- Manlius limestones,
- Bertie limestones,
- Salina formation.

Middle Siluric or Niagaran group.
- Guelph formation,
- Lockport dolomites,
- Rochester shales,
- Clinton formation.

Lower Siluric or Oswegan group.
- Medina sandstone,
- Oneida conglomerate or sandstone.

Below this is the Ordovic. The formations are typically exposed in the State of New York, where the lower members are conglomerates and sandstones, the middle shales, limestones and dolomites, and the upper shales and shaly limestones. The formations are best exposed along the Niagara River, where most of them are visible. The aggregate thickness here is 2,100 feet, though the upper member (Manlius) is partially absent. Eastward in New York some strata thin out, while others are absent through erosion. The Siluric strata are well developed in Michigan, Ohio, Indiana, Illinois, Wisconsin, Kentucky, and Tennessee, though generally much thinner than in New York. They are also more calcareous. In the Appalachians the Siluric strata are frequently represented by shore deposits. Throughout most of their extent, the strata are richly fossiliferous, containing sponges, graptolites, corals, trachiopods, mollusks and trilobites. Fish are also found, but are rare. Toward the end of Siluric time the remarkable crustaceans known as eurypterids (q.v.) became abundant and constituted a marked feature of the life.

During mid-Siluric time the interior continental sea was united with the waters covering parts of Europe, probably by a channel across the Arctic region. This permitted migration from European seas into central North America, so that we find many Siluric fossils of this region also common in the European localities (Gotland, etc.). Migration along an Atlantic coast line between Western Europe and eastern North America also took place in Siluric time, as shown by the similar formal characteristics of the Siluric beds of Maine and the island of Anticosti to those of southern England.

In late Siluric time the waters of the interior sea were entirely enclosed and life became extinct, the sea water itself becoming highly concentrated. In this enclosed basin the salt-bearing strata of the Salina formation were laid down. See GEOLOGY; SALINA FORMATION.

A. W. GRABAU,
Of Columbia University.

Silu'ridæ. See CATFISH.

Silu'rist, The. See VAUGHAN, HENRY.

Silvanus, sĭl-vā'nŭs. See MARS.

Silvela, Francisco, Spanish statesman and Conservative leader: b. Madrid 1843; d. 29 May 1905. He studied law, and entering political life was elected to the Cortes, where he became prominent as a Conservative. He several times held cabinet positions in ministries organized by Campos and Canovas, but in 1891 became the leader of a new Conservative party. On the downfall of the Sagasta ministry after the Spanish-American war he was appointed prime minister, as the recognized leader of the Conservatives and Catholics. He avoided extreme measures, and aroused opposition because he did not bring about the expected reforms; he therefore withdrew from the ministry in 1900, but was again placed at the head of the cabinet in December 1902.

Silver, one of the best known metals, has been in use for a long period, probably since before the beginning of history. It is widely distributed and can be easily extracted from some of its ores.

Physical Properties.— Silver is very malleable and ductile, being surpassed only by gold in these qualities. It is harder than gold, but softer than copper. It can be rolled into sheets 1/1000 inch thick, and silver foil is made thin enough to transmit light. Silver leads all the metals as a conductor of electricity and is second only to gold as a conductor of heat. Its specific gravity is about 10.46; its melting point 960° C., and it can be distilled as a greenish vapor in the electric arc, its boiling point being over 2,000° C. When molten it can absorb oxygen to 22 times its own volume; this is given off when the metal cools, causing the phenomenon known as «spitting.» This occurs only when the silver is pure and a very small per cent of copper, zinc or bismuth prevents it, as does a layer of some substance having no oxydizing action on the molten metal, like powdered charcoal or common salt.

Chemical Properties.— Silver alloys readily with mercury, lead, zinc, gold and copper. The alloy with mercury, known as silver amalgam, is formed in various processes for extracting silver from ores, mercury being able to extract metallic silver from its compounds with chlorine, bromine and iodine. If such an amalgam be heated above the boiling point of mercury, the mercury volatilizes, leaving the silver. Lead has the power of extracting silver from its compounds with copper, sulphur, arsenic, antimony and silver salts by the formation of lead-silver alloys, a property of great metallurgical importance in the treatment of silver ores. Alloys of silver and copper are formed in smelting argentiferous copper ores, the silver and copper being subsequently separated by refining. As pure silver is soft and abrades easily, all silver used in coinage or for making silverware is alloyed with copper to give hardness. The United States silver coinage contains 900 parts silver and 100 parts copper; British coinage contains 925 parts silver and 75 parts copper.

Silver is not affected by either dry or moist air at ordinary temperatures, neither is it affected by caustic alkalies, or vegetable acids. It is dissolved by hot, concentrated sulphuric acid, and easily dissolved by nitric acid. Sulphuretted hydrogen forms black silver sulphide and to this is due the familiar tarnishing or blackening of silverware, either by articles of food containing sulphur, as eggs, or by the minute percentage

Digitized by Google

of sulphuretted hydrogen contained in city air or the air of rooms when coal gas is used as an illuminant. So-called oxydized silver is silver with a superficial black coating obtained by immersing in potassium sulphide, or platinum chloride. Frosted silver has a rough dead surface produced by heating with nitre.

Silver forms three oxides, but none is of any particular importance. Silver chloride ($AgCl$), readily formed as a curdy white precipitate on adding a soluble chloride to an acid solution of a silver salt, is insoluble in acids but readily soluble in ammonia, in potassium cyanide and in sodium hyposulphite and less soluble in a saturated solution of any one of several chlorides. It is also formed in treating silver ores with common salt. Silver nitrate ($AgNO_3$), formed by dissolving silver in nitric acid, is a white crystalline salt readily soluble in water. Fused and cast into sticks it is known as lunar caustic and is used in surgery. In solution it is used as a chemical reagent. Silver bromide ($AgBr$) and silver iodide (AgI) resemble the chloride and like it are used in photography. Silver sulphate (Ag_2SO_4), a slightly yellow crystalline salt, is readily soluble in hot water but less in cold. Silver sulphide, black, is formed by adding a soluble sulphide to a silver salt.

Silver Ores.— The minerals which, singly or in combination, are mined as silver ores may be divided into three classes: Silver minerals proper, lead silver minerals, and lead copper minerals. In the first class come native silver; cerargyrite, argentite, pyrargyrite, proustite, etc. Native silver occurs in irregular bunches or thread-like, or branching masses, either by itself or associated with other silver ores or with native copper. It adds to the value of an ore body, but rarely occurs in sufficient quantity to be worked for itself. The once famous Silver Islet mine on the north shore of Lake Superior produced splendid specimens of native silver. Cerargyrite, horn silver, is the chloride, and contains 75.3 per cent of silver when pure. It occurs in horn-like masses, of a grayish color which turns black on exposure to light, is so soft that it can be easily cut with a knife and is of common occurrence in what is known as the oxydized zone of mines worked for silver. Rich masses have been taken from the mines at Leadville, Colo., and there are many other mines producing this ore in the West. Larger quantities have come from some Mexican mines, particularly those in Guanajuato. Embolite, a chlorobromide, $Ag(ClBr)$, bromyrite, the bromide, and iodyrite, the idodide, resemble horn silver closely and are found associated with it. Argentite, or silver-glance, silver sulphide (Ag_2S) is the commonest of the silver minerals proper. It is black, has a metallic lustre and cuts easily, though harder than horn-silver. When pure it contains 87.1 per cent of silver. Silver sulphide combines readily with the sulphides of antimony or arsenic, forming double salts. Of these pyrargyrite ($3Ag_2S.Sb_2S_3$) or ruby silver ore contains 60 per cent of silver, proustite ($3Ag_2S.As_2S_3$), also called ruby silver ore, contains 65.5 per cent; stephanite ($5Ag_2S_1Sb_2S_3$) 68.5 per cent, and polybasite $Ag_2S.Sb_2S_3$) nominally contains 75.6 per cent silver but usually part of the silver is replaced by copper and part of the antimony by arsenic. These double sulphides at American silver mines seldom occur in bodies of sufficient size and purity to be worked alone, but are not uncommon. One or more are found at mines in Montana, Idaho, Utah, Colorado and Arizona. Large masses of pyrargyrite have been taken from mines in the state of Guanajuato, Mexico. Mention may be made of the mines in the Ruby District, of Gunnison County, Colorado, and at Silver City, Idaho.

Silver being a precious metal a small per cent of it in lead or copper ores makes it the metal of chief value. Even when it is the metal of lower value a few ounces in a ton of ore means the difference between profit and loss in working a mine. Of the lead-silver ores by far the most important is galena, lead sulphide (PbS). Practically all galena contains silver, the extremes being represented by galena from Carinthia, Austria, containing .05 ounce per ton, and from Idaho, up to 2,040 ounces per ton. In galena the silver is present either as isomorphous silver sulphide, or some finely disseminated silver mineral. In oxydized lead ores, cerussite, etc., the silver is mostly present as chloride. Of the strictly copper silver ores, the most important is tetrahedrite, or gray copper ore, which is essentially a sulphide of copper and antimony ($4CuS.Sb_2S_3$), though actually of very varying composition, and the related mineral tennantite ($4Cu_2S.As_2S_3$), also called gray copper. These minerals are of common occurrence in Gunnison, Clear Creek, Summit and Gilpin counties, Colorado. Silver is also found associated with chalcopyrite, chalcocite, bornite and other copper minerals, also with iron pyrite, zinc blende, hematite and various minerals, all of which may be classed as silver ores when the percentage of silver is enough to make its extraction profitable. To-day the largest part of the world's silver supply comes from mines not worked for silver alone but rather for gold, copper or lead, the silver being a by-product. Thus it happens that the operation of many silver-producing mines and the resulting output of silver depend not on the market price of silver but on the price of lead or copper. It is altogether likely that the proportion of silver obtained from strictly silver mines will be smaller in the future than it is now, while owing to improvements in metallurgical processes the proportion of by-product silver will increase.

Metallurgy of Silver Ores.— Silver ores as previously noted may be divided into silver ores, proper, silver-lead and silver-copper ores. They may also be divided into (1) free-milling; (2) refractory, and (3) smelting ores. The first includes native silver, also the chloride and bromide of silver, the metal being extracted by its forming an amalgam with mercury. In so-called refractory ores, usually silver sulphide with or without the sulphides of arsenic and antimony, the ores are roasted with salt or otherwise treated prior to amalgamation. The smelting ores include particularly silver-lead and silver-copper ores. The oldest of the methods of extracting silver by amalgamation, one still used in Mexico, is the patio process. In this the ore is coarsely crushed by stamps or by a Chilean mill, then transferred to an arrastra, a circular space paved with stone, where the ore mixed with water is ground fine under

Digitized by Google

heavy stones drawn around by mules. By the addition of mercury all gold and free silver are extracted. The wet ore is then spread on the patio or amalgamating floor, thoroughly mixed with 3 to 5 per cent of salt, by mules treading it, allowed to stand a few days and then copper sulphate and mercury are added and the ore well trodden for several days, mercury being added from time to time to collect the silver as an amalgam. The chemical reactions which take place are complicated. Finally the mass is washed to remove non-metallic material, the heavy silver amalgam is collected and the mercury recovered by distillation, leaving the silver. Of the modern amalgamation processes the Washoe was developed for treating the complex silver-gold ores of the Comstock lode. The ore was broken in a crusher, reduced to pulp by stamps and then transferred to iron pans 4 to 6 feet in diameter, known as amalgamating pans. The pans had a false bottom or die, on which revolved an iron plate, or muller, having cast-iron shoes. The ore pulp, one to three tons, with the necessary amount of salt, copper sulphate and mercury, was heated with a steam coil or by blowing in steam and ground three to five hours. Then the light material was washed away and the amalgam collected. Various modifications of the Washoe process have been devised and there are still many mills using some form of pan amalgamation, but the extraction is usually not very high. Silver chloride is soluble in a saturated soluble solution of salt and more soluble in sodium hyposulphite. Hence processes have been devised which aim to convert the silver in an ore to a chloride by roasting with salt, and then remove it by leaching. In the Augustin process the roasted ore is leached with a solution of salt, and in the Russell process with sodium hyposulphite and cuprous sodium hyposulphite. Neither process is now in use in the United States.

Smelting, where practicable, has the advantages of simplicity, speed and often high extraction as compared with all other methods of treating ores not free-milling. It is the regular method of treating lead-silver and copper-silver ores. Lead ores are smelted in the usual way (see LEAD); the silver goes into the lead and is recovered by the zinc, or Parkes, process. In the copper ores (see COPPER) the silver goes with the copper and may be separated by electrolytic refining. Gold-silver alloys obtained from milling or smelting ores of many varieties are also treated electrolytically (see GOLD). The silver obtained from some silver-lead ores is often purified by cupellation. A small reverberatory furnace with a hearth of bone ash is used. The lead bullion is melted, the lead oxydized to litharge by a jet of air until the silver bath is clear, then the silver is cast in molds forming silver pigs or bars. Many ores carrying silver go to concentrating mills equipped with jigs, vanners, etc., for separating the ore from the gangue. The concentrates thus obtained are usually smelted.

Silver Producing Districts.— The largest single producer of silver in the world to-day is the Broken Hill Proprietary Co., of New South Wales, Australia. The once famous Comstock lode mines in Nevada, which produced ore carrying values of two parts gold to three parts silver, are now unimportant, and probably the largest individual silver producer in the United States is the Amalgamated Copper Co., the silver being a by-product of its mines at Butte, Mont. Leadville, Colo., is an important silver producing camp, but the ores are now generally low-grade. Silver Cliff and Aspen, Colo., were noted for their output of high-grade silver ores. In Utah the mines at Park City, notably the Daly West, are large producers of silver, though the ores also contain gold, lead, and copper. In Idaho the silver-lead mines of the Cœur d'Alene region produce in the aggregate much silver. In Mexico the states of Chihuahua, Durango, Guanajuato and Hidalgo all contain important silver-gold or silver-lead mines. The mines of Guanajuato are estimated to have produced one sixth of the silver of the world and the Valenciana has an established record of production of 300,000,000 ounces. In South America the once famous mines of Cerro de Pasco in Peru are to be worked again by a New York company, but chiefly for copper. The silver output of the Cerro de Pasco mines from their discovery in 1630 up to 1886 is estimated at 462,250,000 ounces. In Europe, Germany is the most important silver-producing country, the metal coming from the Mansfeld copper mines, the silver-lead mines at Mechevnich and the mines of the upper and lower Harz.

The world's production of silver in 1908 amounted to 203,186,370 troy ounces, valued at $108,684,400. Mexico that year led the world in silver production, and Mexico and the United States together produced nearly 70 per cent of the total output. The principal silver-producing countries are as follows, the figures being taken from 'The Mineral Industry':

COUNTRY	Troy oz.	Commercial value
Mexico	73,664,027	$39,402,900
United States	52,440,800	28,050,600
Australasia	17,175,099	9,187,000
Bolivia and Chili	5,806,117	3,105,700
Spain	4,175,674	2,233,000
Germany	35,728	19,100
Canada	22,106,233	11,824,600
Peru	9,566,118	5,116,900
Colombia	1,375,039	735,500
Japan	3,801,315	2,033,300

With the exception of the years 1895 and 1902 when Mexico first led, the United States led the world in silver production for over 30 years up to 1902. Of the continents North America is easily first, with Europe now second.

According to the same authority the output of the chief silver-producing States of the Union in 1909 was as follows:

STATE	Troy oz.	Commercial value
Colorado	9,093,600	$4,730,100
Montana	12,000,000	6,241,900
Utah	9,533,400	4,958,900
Idaho	7,054,500	3,669,500
Nevada	8,953,000	4,657,000
Arizona	3,632,200	1,889,300
California	1,705,200	887,000

Uses of Silver.— Silver is used for coinage and for ornamental articles, while the chloride, bromide and iodide of silver are of great importance from their use in photography. Articles plated with silver are in common use, as the cost of plating is small if the film of silver deposited is thin. A solution of the double salt

Digitized by Google

potassium silver chloride (KCN.AgCN) is used, from which the silver is readily deposited. The articles to be plated are thoroughly cleaned, attached to the negative pole of an electrical circuit of low voltage and immersed in the bath, a silver plate being attached to the positive pole. The silver as deposited has a dead surface but is made bright by burnishing after removal from the bath.

In photography silver chloride in a layer of albumen or gelatine is used on the ordinary printing papers; various organic compounds are formed which are changed on exposure to light, and this change is shown by the action of certain reducing agents, developers, the resulting image being formed of unknown silver salts suspended in the gelatine. In bromide prints which are more durable, the image is due to finely divided metallic silver. In the ordinary photographic dry plates, silver bromide or iodide is used in a gelatine film, as these salts are more easily affected by light. See BIMETALLISM; COINAGE; ELECTRO-CHEMICAL INDUSTRIES; COPPER; GOLD; LEAD; PHOTOGRAPHY.

For statistics of production consult 'The Mineral Industry' and the 'Mineral Resources of the United States'; for metallurgy see Schnabel, 'Metallurgy'; the 'Engineering and Mining Journal' and the 'Proceedings' of the American Institute of Mining Engineers.

SAMUEL SANFORD,
Assoc. Editor 'Engineering and Mining Journal.'

Silver, Fulminating. See EXPLOSIVES; FULMINATES.

Silver Age, the designation applied to the second mythological period in the history of the world, under the care of Jupiter. It succeeded the Golden Age. The phrase is also applied to a period of Roman literature succeeding the most brilliant period, and extending from about 14 A.D. to 180 A.D.

Silver Certificates. See FINANCE.

Silver Fir. See FIR.

Silver Fox, a glossy black variety of the Canadian red fox (*Vulpes fulvus*) with a silvery grizzle on the forehead, and on the flanks passing upward to the rump. It is extremely rare, and the fur is very valuable.

Silver Grays. See WHIGS.

Silver Lace. See LACE.

Silver Plate. See PLATE.

Silver Question. See BANKS AND BANKING; BIMETALLISM; BRYAN, WILLIAM JENNINGS; DEMOCRATIC PARTY; MCKINLEY, WILLIAM; MONEY.

Silver Standard. See BIMETALLISM.

Silver Wedding. See WEDDINGS.

Silverberry. See OLEASTER.

Silvering. See GILDING.

Silvering Glass. See MIRROR.

Silverside, a name given to various small fishes because of their bright silvery color and especially to members of the family *Atherinidæ* of the order *Percesoces.* These fishes have the third upper pharyngeal bone enlarged, slender and elongated bodies with rather large, easily detached cycloid scales. The spinous dorsal fin is weak and well separated from the soft dorsal, the ventral fins are on the middle of the abdomen and the pectorals at a high level. Most of them are small carnivorous fishes living in schools in shallow bays of the sea, but a few are fresh-water. They are important chiefly as food for other fishes, but several of the larger ones are valued as human food. Fifteen genera and 60 species have been enumerated, most of which are North American. They abound especially in the Gulf of Mexico. *Menidia notata* is the form best known along the coast of the New England and Middle States, where it abounds. It is a delicate translucent little fish of a greenish color, has a conspicuous lateral silvery band, and is found everywhere along the shores in large schools. They may be fried to a crisp and eaten whole like smelts. The brook or lake silverside (*Habidesthes sicculus*) is found abundantly in ponds and sluggish streams throughout the Mississippi Valley and Southern States, and is often called skipjack. Consult Jordan and Evermann, 'Food and Game Fishes' (New York 1903).

Silverware. Under this head it is intended to describe silver plate in the usual sense, with such reference to gold plate and that made of gilded silver as may be necessary. There has always been in European countries a small percentage of gold table vessels; and a still smaller proportionate amount of gold plate made for pure ornament, in Europe and in the Orient. "Silver gilt" on the other hand, has been, at certain epochs, very popular; and modern collectors find a charm in the look of the old pieces from which the gilding has been rubbed so much that the yellow look of the gold is reduced to a pale tone, modifying the color of the silver but slightly.

The making of silver plate involves most of the processes of metal work, those being excluded which are peculiar to certain metals other than silver and gold. Casting and then finishing the cast by means of the chasing tool, the graver, the file, etc.; hammering, whether by the hand hammer or by the snarling-iron, which is a fixed hammer with an elastic handle upon which an assistant strikes rapid little blows, thus setting the head of the hammer into motion; drawing out, as wire, of any section or similar drawing out of the metal into tubes, all of which is done by the silver-smith himself in fine hand-work; saw-cutting, by which a pierced pattern can be made easily; soldering, by means of which not only are the parts of a vessel put together, but also ornamental additions made, whether mere balls or grains of gold as in much Greek and Etruscan work, or in the form of figures, medallions, floral and other adjuncts which may either be of the solid metal, or of the precious metal in a thin sheet with a core of a less valuable substance such as tin; all these are used continually in making silverware. The modern uses of machinery are in the main attempts to carry out these different kinds of work with less labor; thus rolling out metal into sheets takes the place of hammering out flat; spinning up by means of a revolving mold takes the place of hammering into shape, as the bowl of a drinking cup; and the like: the tendency being always to use machinery even where its use destroys the effect of the piece. It is extremely difficult to avoid a mechanical hardness in machine-made work, because the machine produces all that it

Digitized by Google

does in exact fac-simile, one piece of another. A thin plate of silver hammered by hand is of slightly different thicknesses in its parts and it is nowhere perfectly smooth; whereas the rolled sheet of silver is as uniform if not as smooth as the surface of a mirror, and the use of such a smooth surface injures greatly the artistic effectiveness of the piece of which it forms a part. The above described processes make the piece; but there are several decorative appliances which may be used to modify its appearance. Thus enameling is used very freely both with silver and silver gilt (see ENAMELING), and niello (q.v.) is used especially with silver as one of the most common methods of ornamentation.

An old-fashioned silver goblet may be made of the following pieces: a bowl, a foot or base, a shaft or stem which unites the bowl to the foot, and such additional pieces as may be put on for ornament. Let us take a somewhat ornamental piece and consider the probable way in which it has been made. The bowl, whether perfectly circular or shaped with lobes into a six-leaved or eight-leaved or other section, will be hammered by hand with tools which are sometimes of metal but more often of hardwood or horn. An anvil is used with a beak, and this may be adjustable, or again a "stake," that is to say, a solid curved bar of iron fixed in a wooden block or a vise, may serve all the purpose. Also a wooden shaping-block may be used upon which the thin metal is applied when it has reached a certain approximation to the shape desired and upon which the hammering is continued. The exact shape is got by frequent measuring with dividers or compasses, or by fitting upon a mold. Still, hammering upon a stake is the ideal system, and the little irregularities caused by the hammer strokes are not to be effaced with too much care, as their slight changes of surface help the design. In saying this it is not meant to praise the modern trick of distributing hammer strokes over the whole surface with deliberate purpose of giving it a honey-combed appearance. That is often an affectation without fortunate results. The foot may be made in exactly the same way as the bowl, that is to say, it may be an inverted bowl of a different shape as is very often the case; or the hammering may be carried farther until the hollow part of the bowl disappears in a nearly flat disk resembling the flat foot of a wine-glass. The stem may be of solid casting and may even be a little statuette, or even a group of two or three human figures closely united in a single mass of metal; or a design of parts alternately more or less projecting, with prettily molded transitions from the projections to the hollows, may be used. This solid stem may be secured to the top and the foot by soldering, or by boring a hole in the cup and foot and passing the ends of the stem through these holes, where they are then hammered out in the way that the head of a rivet is formed, the rough heads being then covered by another plate of silver or by solder. The bowl will very often be lined, that is, an inner bowl will be laid into the outer one, and this with the purpose of concealing the inner face of the outer bowl. The reason for this is that if the outer bowl is decorated by hammering with patterns showing in relief on the exterior, those patterns show in hollows in the interior in what is thought an awkward way. Of course in a very rich piece of metal work this will not be the case, and the inside of the hammered bowl will not be concealed: but in pieces for table use it is found a convenience to give a perfectly uniform and smooth interior, and this custom of lining is therefore common. In making a drinking-cup it is possible, as was said above, to add other pieces of metal to the three principal parts. Thus a thin sheet of silver may be secured between the bowl and the stem, the stem passing through it; and if this sheet has been cut into minute subdivisions, somewhat long and slender and radiating from the centre, these subdivisions may be twisted and curled afterward to produce an effect like that of the petals of some varieties of chrysanthemums or other blossoms. So a plate of silver inserted in like manner at either the bottom of the bowl or the top of the foot may have been hammered into shape and embossed into a pretty pattern, and the edge only slightly lobed or engrailed, that is, cut into convex or concave curves in close juxtaposition along the edge. The processes of hammering thin metal into ornamental patterns are commonly spoken of as repoussé work. The thin plate of metal may be held with a pair of nippers with one hand, and steadied upon something which takes the place of an anvil, such as a beating-block of wood, and then attacked by the hammer held in the other hand. On the other hand the use of the snarling-iron is necessary wherever the piece is already hollowed, like a bowl or goblet or jar, for then the piece can be held firm upon the point of the snarling-iron which is inside, and to which motion is communicated as stated above. In either way the work is done on the "wrong side" of the piece and the artist in most cases watches the right side either continually, as when the snarling-iron is used, or at frequent short intervals, as when he is hammering by hand. The relief pattern produced in this way is to be worked all over with the chasing tool at a later time, its modulations altered more or less, the edges of the embossings made more sharp and distinct or softer, as may be desired, and the amount of relief even diminished in certain cases by driving the silver back. In order that this may be done to better advantage the hollow bowl is filled with some firm and yet slightly yielding material such as pitch, or the plate, if not hollowed, may be held upon a pitch-block which is merely a solid block of wood with the upper surface hollowed out and filled with a kind of cushion of the pitch.

It is evident that very often a piece of silverware can be formed at one operation, however much the workman may elaborate its surface afterward. Thus a goblet without a foot, tumbler-shaped or beaker-shaped (that is, with a flaring and rounded lip) or mug-shaped (that is, with the lip somewhat smaller in circumference than the base) may all be made at one operation, or else the greater part of the top may be thus made at one operation and the bottom soldered in. It is very common to cut the form of a mug or beaker out of thin silver and then to roll it up and solder together the meeting edges, which edges may have been in the first place notched or clipped in such a way that the mere hammering can unite them rather closely together, even to the extent of making the junction water-tight.

History.—The silverware of antiquity is but little known because of the perishable character of the metal. Gold, on the other hand, remains intact even in damp soil. It appears, however, that in the Mediterranean world of antiquity,

Digitized by Google

gold was much more common relatively to silver than in modern times. The wall paintings of Egypt show vases of many forms, some of extreme beauty, and these are commonly colored yellow, and in at least some cases they are distinctly described as being of gold. Silver vessels of ancient Egypt exist, however, in different museums, and many silver bowls have been found in Cyprus, some of which are adorned in relief in a semi-Egyptian style, Asiatic principles of design being mixed in a curious way with Egyptian details.

Silverware of pure Greek epochs is very uncommon, but a few beautiful pieces have been found in tombs. Græco-Roman work is much more common in our museums; the famous so called Cæsar vase, a two-handled drinking cup, in the museum at Saint Germain near Paris, the still more elaborate one in the Naples Museum, the famous Hildesheim treasure in the Berlin Museum, including a score of most decorative pieces, and the other hardly less important finds made in Italy, especially in Pompeii and its immediate neighborhood, or some found on the shores of the Black Sea, such as the famous Petrossa treasure of gold objects which was exhibited at Paris in 1900 and which is preserved permanently in the museum at Bucharest, are all valuable specimens. By far the greater part of our possessions in ancient silverware is of the mediæval epoch beginning with the 8th century, except for a very few earlier pieces. The treasury at Aix-la-Chapelle and the Cathedral of Monza in Lombardy possess specimens of the 8th and 9th centuries, and the treasuries of many Italian churches have a specimen or two of fine work. Perhaps the richest of all is the treasury of Saint Mark's Church at Venice, and in that church the famous altar-piece called the «Pala d'oro» remains as the most important piece of 10th and 11th century work remaining in Europe. This superb piece, finely engraved and given in great detail by Labarte (see his book in bibliography), is a wonderful combination in gold and silver gilt with sculpture in relief and much ornamental setting of jewels — true and imitation. Throughout the Middle Ages altar vessels, that is, pieces used for the eucharist, were made often of copper or bronze, but also very often of the precious metals, and these were often richly ornamented with enamels. Some few such pieces remain; enough, indeed, to almost allow us to restore in imagination the condition of the art of silver work in the 12th and 13th centuries and later. Domestic vessels and those made for the state occasions of certain noble families, royal courts, or associations and guilds, are not uncommon. There are many preserved in England, where there has been less destruction of these non-ecclesiastical pieces than on the Continent because of the continuity of English political and social conditions; although the ecclesiastical plate of the British Islands has disappeared in great measure because of the religious changes of the 16th century. Silverware of the 18th century is preserved in England in great quantities because of the number of families which have held their possessions until in recent times their value has become so enormous that they pass into the market or are sold at auction and gravitate toward permanent collections.

The best guide to the study of such English ware and a good book of reference is the following: Cripps, W. J., 'Old English Plate, Its Makers and Marks,' of which the eighth edition was printed in 1903. In this book there are full tables of those established and recognized stamps, the makers' marks and plate marks by means of which the date and often the maker of a piece can be ascertained. By the same author there is a smaller book, 'Old French Plate,' a handbook for the collector, first printed in 1880. Chaffer's 'Hall Marks on Gold and Silver Plate' (6th edition, London 1883), and probably later editions, is a useful book of reference. There is a a small book of much interest by J. H. Buck, 'Old Plate, Ecclesiastical, Decorative and Domestic' (New York, 1888); Montague Howard, 'Old London Silver' (New York and London 1903) is a quarto book with many illustrations and tables of marks. The most instructive book for the artistical side of the study is probably the catalogue of the South Kensington Museum, 'Ancient and Modern Silver-Smith's Work,' by John Hungerford Pollen. There is a valuable catalogue of the exposition of silver plate held by the Burlington Fine Arts Club in London, with many fine illustrations, and a catalogue of a loan collection of plate held in the Fitzwilliam Museum, Cambridge (England) 1896. Books of illustration are numerous, and since the general introduction of photo-engraving of different kinds these have become extremely valuable. Such are 'Corporation and College Plate,' published by the Arundel Society, for Promoting the Knowledge of Art, London 1869; 'Die Silberarbeiten von Anton Eisenhoit,' by Julius Lessing, Berlin; 'Meisterwerke alter Goldschmiedekunst aus dem 14.–16. Jahrhundert,' Frankfort-am-Main 1883. There are also the important treatises on industrial and decorative art, of which one of the most valuable is Jules Labarte's 'Histoire des Arts Industriels,' first published in 1866; second edition somewhat modified.

RUSSELL STURGIS.

Silves'ter, or **Sylvester**, the name of two popes and an antipope, as follows:

Silvester I., Saint. He succeeded Saint Melchiades in 314, and his pontificate lasted till 335. He presided through his delegate at the Council of Nice, and is said to have held a council at Rome to condemn the errors of Arius and others. The story of his having baptized Constantine and received Rome and its temporalities as a donation, is pure fiction. Many churches were built or completed in his reign. During his pontificate the Arian heresy was at its height, against which Saint Athanasius was the great opponent.

Silvester II. (GERBERT): b. Auvergne; d. Rome May 1003. At an early age he entered the monastery of Saint Gerard, in Aurillac, and after laying a foundation for all the sciences cultivated in that age he went to Spain to hear the Arabian doctors, and was later appointed by Hugh Capet preceptor to his son, Robert. Otho III., emperor, who had also been his pupil, conferred upon him the archbishopric of Ravenna in 998; and on the death of Gregory V., in 999, procured his election to the papacy, when he took the name of Silvester. He was a great promoter of learning, and a proficient in various branches of science himself, his scientific knowledge procuring for him the reputation of a magician. He composed a number of works.

Digitized by Google

particularly on arithmetic and geometry; and with his own hands made a clock, a globe, and an astrolabe. Several of his letters on various subjects were printed at Paris in 1611; but the most complete collection has been given by Du Chesne. He was the first Frenchman to ascend the papal chair.

Silvester III. On the expulsion of Benedict IX. from Rome 1044, he was chosen in Benedict's place. His sway as pope or antipope lasted but three months, however, and after being expelled from Rome in his turn he was deposed by the Synod of Sutri in 1046 and confined in a monastery.

Silybum, a genus of composite plants, the best known species being the holy thistle or lady's milk. *S. marianum* (*Carduus marianus*), a tall plant with large spreading prickly leaves. Those near the base are pinnatifid, and spotted with white, stained, according to legend, by drops of the Virgin's milk. It was formerly cultivated in English gardens, not only for ornament, but also for its edible roots, leaves, and large, purple heads, surrounded by spiny involucre. It has become naturalized in Ontario.

Simancas, sē-män'käs, Spain, 7 miles southwest of Valladolid, on the Pisuerga, is an old walled town. The ancient castle was converted into a record hall, where the archives of the kingdom have been preserved since the reign of Philip II. (1563). They comprise 30,000,000 state and private documents, and occupy 46 rooms. Pop. 1,200.

Simbirsk, sĭm-bērsk', Russia, (1) capital of a government of that name, on the Volga, 576 miles by rail southeast of Moscow, is a well-built town. The chief buildings occupy an eminence overlooking the river; the business portion is lower down, and still farther are the quarters of the poor. There are two Greek cathedrals, gymnasia for children of both sexes; several other mixed schools, a sanatorium, two public libraries, a good theatre, and many flourishing benevolent institutions. There is a public garden on Vyenets Hill, and numerous private gardens. Fruits are cultivated and exported. Fishing is one of the chief occupations. Trade in corn, potash, wool, fruits, wooden ware, and manufactured goods is considerable. As usual in Russian towns, an enormous business is transacted at the annual fair. Karamzin was born here. Pop. about 45,000. (2) The government of Simbirsk contains an area of 19,110 square miles. Its vast plain is watered by the Volga, and is fertile. The higher portions are at the east. The west is traversed by numerous rivers, and the Sura is the principal stream in this section. Its tributaries are not navigable. The forests of the government are quite extensive; there are broad pastures, much arable land, a few lakes and marshes. The climate is temperate, comparatively speaking. The chief crops are cereals, flax, hemp, tobacco, and hay. Fish are abundant. Sulphur, iron ore, salt, ochre, asphalt, and building stones are quarried. All kinds of wooden ware are made, besides felt goods, nets, ropes, gloves, caps, and handkerchiefs. The larger manufactories include woolen mills, distilleries, tanneries, glass and starch works, and flour mills. The exports are grains. Pop. 1,750,000.

Simcoe, sĭm'kō, **John Graves,** first governor of Upper Canada: b. Cotterstock, Northamptonshire, England, 25 Feb. 1752; d. Torbay, Devonshire, 26 Oct. 1806. He was educated at Oxford, and in 1771 entered the army as ensign. He fought throughout the war against the American colonies, and was made a colonel in 1781. Returning to England after Cornwallis' surrender, he entered Parliament in 1790 as member for St. Mawe's, Cornwall; and in 1791 on the division of the Canadas, became the first lieutenant-governor of Upper Canada. He established his capital at Newark (now Niagara) on 8 July 1792 and began his administration with a legislature of seven members. He encouraged the loyalists from the independent states to settle in the new country and devoted himself to its agricultural development and military defense. In 1793 he set about removing the seat of government from Newark to Toronto, which capital he practically founded. In 1794 he was appointed commandant of Santo Domingo; but returned to England in 1797, where he was promoted lieutenant-general. In 1806 he was appointed commander-in-chief in India, but was taken ill on the voyage out and obliged to return.

Simcoe, Lake, Ontario, Canada, a lake situated about midway between Georgian Bay and Lake Ontario. It is about 30 miles long and 18 miles wide, and contains several islands. The banks are densely wooded, and good whitefish are found in its water. It discharges into Georgian Bay through the Severn River. Barrie and Orillia, connected with the Canadian railway system, are the chief towns on its shores.

Simcox, sĭm'kŏks, **Edith Jemima,** English miscellaneous writer: b. 1844; d. 1901. She contributed largely to the 'Academy'; the 'Fortnightly Review'; and other periodicals, at first using the pseudonym, "H. Lawrenny." Her published volumes were: 'Natural Law: An Essay in Ethics' (1877); 'Episodes in the Lives of Men, Women, and Lovers,' stories (1882); 'Primitive Civilizations, or Outlines of the History of Ownership in Archaic Communities' (1894).

Simeon, sĭm'ę-ŏn, the second son of Jacob and Leah, and ancestor of one of the Twelve Tribes of Israel, which dwelt to the north of the tribe of Judah. When Simeon and his brethren went into Egypt to buy corn, his brother, Joseph, then chief minister of Egypt, but not yet known to his brethren, insisted on Benjamin, the youngest brother, being brought to him, and detained Simeon as a hostage for his forthcoming.

Simeon Stylites, stī-lī'tēz. See PILLAR SAINT.

Simeto, sē-mā'tō, or **Giaretta,** jä-rĕt'tä, the largest river of Sicily. It flows west and south of Mount Etna into the Gulf of Catania, is 93 miles long, but unnavigable.

Simferopol, sĭm-fĕr-ō'poly, Russia, capital of the government of Taurida, on an elevated plain at the foot of lofty hills, 40 miles northeast of Sevastopol. It consists of an old and a new town — the former poorly built, and occupied chiefly by Tartars, the latter with a handsome square and regular, spacious streets, and has several churches and mosques, a gymnasium,

Digitized by Google

and a larg. civil and military hospital. Pop. about 60,000.

Simi'adæ, the family which embraces the anthropoid apes. See APE, and the names of the animals there referred.

Sim'la, India, the chief town of a district of the same name in the Punjab, the most important of the hill-resorts, and the summer headquarters of the Indian government; about 98 miles north-northeast of Ambala, 7,156 feet above the sea, and since 1903 connected by a mountain railway with the Peninsular railway system. Simla is situated on a series of wooded hill ridges, covered with deodars, rhododendrons, and an innumerable variety of ferns; commands a magnificent prospect of the Himalayas; and has an equable temperature that rarely exceeds 70°. The governor-general and the commander-in-chief annually remove hither with their entire staff from Calcutta, and go into residence for six months. All the environs are dotted with picturesque villas, and there are churches, schools, hotels, clubs, banks, etc. The chief schools are the Roman Catholic Orphanage for the children of soldiers, on the model of the Lawrence asylums; the Mayo industrial schools for the orphans of poor civilians; Bishop Cotton's school and the Punjab girls' school, both for the higher education of the children of well-to-do Europeans. The district of Simla which is entirely surrounded by petty native states, has an area of 18 square miles, of which only about 12 are cultivated. The crops are wheat, Indian corn, ginger, and poppy. Efforts are being made to grow hops, tea, and cinchona. The neighboring mountains yield lead, iron, and slate. This tract of hill country was acquired by the British in 1816, as a result of the Gurkha war, and has since been augmented by purchase, lapse, and exchange. The first house was built in 1819; Lord W. Bentinck was the first governor-general to select it as his summer quarters. Pop., town, 15,000; district, 50,000.

Simmons, sĭm'ŏnz, **Edward Emerson**, American painter: b. Concord, Mass., 27 Oct. 1852. After his graduation at Harvard (1874), he studied painting in Paris under Lefebvre and Boulanger. He became a member of the Society of American Artists in 1888, and his works received recognition at the Paris Salon (1882); Paris Exposition (1889); and Pennsylvania Academy (1887). One of his best pictures is 'The Carpenter's Son' (1890).

Simmons, Franklin, American sculptor: b. Webster, Maine, 11 Jan. 1839. He first came into notice in 1865–6, when, at Washington, D. C., he produced several bronze medallions of members of the cabinet and famous army and navy officers, including Farragut, Porter, Grant, Meade, Sheridan, Sherman, etc. In 1868 he went to Rome, Italy, where he now resides. He has executed about 100 portrait busts in marble, and about 15 public monuments, including statues of Gen. Grant and Roger Williams in the National Capitol, and numerous ideal statues, among which are Penelope, Medusa, Seraph Abdiel, Galatea, etc.

Simmons College, located at Boston, Mass. It was founded in accordance with the will of John Simmons, for the purpose of providing education for women in such branches as will enable them to earn their livelihood. It was chartered in 1899 and opened in 1902. The departments of study include household economics, secretarial course, library course, science courses (including general science, preparing for teaching, and medical preparatory), horticulture, and courses in preparation for nursing. The last two were added to the curriculum in the year 1903–4. The full courses are four years in length, but college graduates and others who have had the academic work can complete the technical courses in one or two years. The course in commercial horticulture can be completed in three years, but a full course of four years is also provided; by arrangement with the Massachusetts Agricultural College at Amherst, Mass., only the work of the first two years of the horticultural course is done at Simmons College; the third or the third and fourth years' work is provided for at the Agricultural College. Besides the four years' course in preparation for nursing there is a one year's course especially intended for those who have had college work, and also a short summer course. Students are allowed to take single studies from the curriculum from any department, provided they are qualified for admission to the college and fitted to take up that particular study. Each department, however, leads to a definite practical occupation. There are also evening classes in shorthand, typewriting, languages, English, cookery, etc.; the evening work is not correlated in the same manner as the day work, and is mostly taken by persons occupied during the day who wish to improve themselves in studies relating to their occupations. By an arrangement made with the Boston Cooking School, the property and management of that school was transferred to Simmons College, the Cooking School being represented by a board of visitors. In accordance with this agreement the college offers a special one-year course in cookery in place of the former normal course of the Cooking School, and private practice lessons. The funds of the Cooking School become a permanent fund for two scholarships. The college in 1904 occupies Simmons Hall and two private houses as dormitories. The productive funds in 1904 amounted to $2,220,000; the students in day courses numbered 282, and in evening courses 145; the faculty numbered 40.

Simms, sĭmz, **William Gilmore**, American novelist: b. Charleston, S. C., 17 April 1806; d. there 11 June 1870. He received a secondary education at Charleston, was a clerk in a chemical house, but turned first to the law, then to literature, published a volume of 'Lyrical and Other Poems' (1827), and in 1829 became editor and a part owner of the 'Charleston City Gazette,' which failing in 1833, carried with it his fortune, and necessitated a busy pen. A few of his poems have clung to the anthologies, but he is best known for his works of fiction. Rarely he ventured, and always with failure, to past times and strange lands; but when he laid his scenes in the South and Southwest he was convincing and vigorous; in the Georgia gold fields, in the Southern battle-fields of the Revolution, in forest and bayou he conducted bold adventures, described in a manner suggestive of Cooper, though failing in Cooper's constructive skill. 'The Yemassee,' a story of colonial

Digitized by Google

South Carolina, is generally ranked as his best. Before the Civil War he had attained a very considerable reputation, being somewhat read even in Britain and Europe. After the war he found himself out of vogue. He was at one time editor of the 'Southern Quarterly Review.' Others of his volumes are: 'Atalantis' (1832), a poem; 'Castle Dismal' (1845); 'The Partisan' (1835); 'The Maroon' (1855); 'Eutaw' (1856); 'The Cassique of Kiawah' (1860). Consult Trent, 'William Gilmore Simms' (1892).

Sim'nel, Lambert, English impostor and pretender to the throne: b. Oxford about 1472. While a boy he was trained by a priest, one Richard Simon, to personate the claims of the York faction early in the reign of Henry VII. In 1487 he gave himself out as Edward, Earl of Warwick, son of Clarence, and sole heir of the house of York. He was crowned at Dublin as Edward VI. Supported by troops furnished by malcontent nobles he landed in England, but was defeated a few days later at Stoke. Henry imprisoned Simon for life, but gave Simnel a place in the scullery and afterward made him falconer.

Simnel Cake, a raised cake, with a crust colored with saffron, the interior being filled with the materials of a very rich plum pudding. They are made up very stiff, boiled in a cloth for several hours, then brushed over with egg and baked over a quick fire.

Simois, sĭm'ō-ĭs, or **Dumbrek Su,** Asia Minor, a river rising in the Kaz Dagh-Ida and emptying into the Scamander or Xanthus, now supposed to be identical with the Menderé. Ancient Troy was partly built upon its banks, and the peak of Samothrace towers above it. It bordered the battle fields of the Trojan war, sung by Homer and other Grecian poets.

Si'mon, Joseph, American pioneer: b. 1712; d. Lancaster, Pa., 24 Jan. 1804. Emigrating to Lancaster about 1740, he engaged in the Indian trade, soon becoming prominent in that line and one of the largest land holders in Pennsylvania, his enterprises extending to the Mississippi, while he had an interest in business in the Indian Territory. He supplied the Continental army with rifles, ammunition, drums, blankets, and other supplies. A deed given to him and 11 traders 8 Nov. 1768, still preserved in Independence Hall, Philadelphia, records the treaty of Fort Stanwix, whereby a tract of land comprising the present State of West Virginia was granted to them by all the tribes of the Six Nations. The grant never passed into the hands of the purchasers, owing to Virginia's resistance and the breaking out of the Revolution. Consult: Ellis and Evans, 'History of Lancaster County'; Markens, 'The Hebrews in America,' pp. 78–82; 'Publications of the American Historical Society,' Vol. I., pp. 120–121, Vol. IX., pp. 31–32.

Simon, Joseph, American politician: b. Germany 1851. He was brought to this country in infancy, and since 1857 has been a resident of Portland, Ore. Admitted to the bar in 1872, he was elected to the City Council in 1877, serving for three years. In 1878 he managed the State campaign for the Republicans, and was chairman of the State Central Committee in 1880, 1884, and 1886. He was State senator 1880–98, and was elected president of the State senate in 1889, 1891, 1895, 1897, and 1898. He sat in the United States Senate 1898–1903.

Simon, sē-môṅ, **Jules (François Suisse),** French philosopher and statesman: b. Lorient, department of Morbihan, 27 Dec. 1814; d. Paris 8 June 1896. He was educated at the college of his native town, and in the Ecole Normale, Paris. In 1839 he succeeded Cousin as professor of philosophy in the Sorbonne, but lost this post in 1851 by refusing to take the oath of allegiance to Napoleon III. He was returned to the Constituent Assembly by the department of Côtes-du-Nord in 1848. In 1855–6 he delivered a series of philosophical lectures in several towns of Belgium, and in 1863 he was returned to the Chamber of Deputies for a division of the department of the Seine. He strongly opposed the war with Prussia, and after the revolution of 1870 became a member of the provisional government, and was minister of education under Thiers from 1871 to 1873. In 1875 he was elected to the senate, and member of the Academy. In 1876 he became leader of the Republicans, and was minister of the interior and premier until 16 May 1877, when he was dismissed by MacMahon. He was a consistent advocate of free trade and of liberal principles, and opposed M. Ferry's bill of 1879 for suppressing non-authorized religious bodies. In 1882 he was elected permanent secretary of the Academy of Moral and Political Sciences. He edited various journals, including the 'Siècle' and the 'Echo Universel.' His chief works include 'Histoire de l'Ecole d'Alexandrie' (1844–5); 'Le Devoir' (1854); 'La Liberté de Conscience' (1857); 'L'Ouvrière' (1863); 'L'Ecole' (1864); 'Le Travail' (1866); 'La Politique Radicale' (1868); 'La Peine de Mort' (1869); 'Souvenirs du 4 Septembre' (1874); 'Le Gouvernement de M. Thiers' (1878); 'Le Livre du Petit Citoyen' (1880); 'Victor Cousin' (1887); 'La Femme du XX^e Siècle' (1891); 'Quatre Portraits: Lamartine, Le Cardinal Lavigerie, Renan, L'Empereur Guillaume II.' (1896); etc. He also produced excellent editions of the writings of several great French philosophers, including Descartes and Malebranche.

Simon, Richard, Roman Catholic theologian and scholar: b. Dieppe 13 May 1638; d. there 11 April 1712. He was member of the Oratory in Paris, but soon abandoning the order he spent his life as parish priest in his native town and the publication from time to time of his works alone interrupted the uneventfulness of his career. Yet he must be looked upon as the father of modern Biblical science and he went far beyond the authority of church tradition in handling the origin, authenticity, and interpretation of the Hebrew and Greek Scriptures. Many of his conclusions aroused much bitter controversy in his day and met with the approval of neither the Roman Catholic nor Protestant reader. Although at one time an object of suspicion by the Church authorities, Simon remained a faithful Catholic and died in the Church. His principal publications were: 'Histoire Critique du Vieux Testament' (1678); 'Histoire Critique du Nouveau Testament' (1693); 'Histoire Critique des Principaux Commentateurs du Nouveau Testament' (1693);

Digitized by Google

'Nouvelles Observations sur la Texte et les Versions du Nouveau Testament' (1695). Consult: Bernus, 'Richard Simon' (1869); and 'Notice Bibliographique sur Richard Simon' (1882).

Si'mon Magus, mā'jŭs, a magician, mentioned in the Acts of the Apostles: b. Sitton in Samaria. He professed to be an æon of an exalted nature, and called himself the supreme power of God. (See GNOSTICS.) Struck with astonishment at the miracles of the apostles, and at the effect which followed the imposition of hands, he offered them a sum of money to be endued with similar powers. His proposal met with an indignant refusal on the part of Peter; and from the fact of Simon Magus being the first person who attempted to traffic with money in spiritual functions and endowments, the term simony has been employed to designate such traffic. (See SIMONY.) After this Simon traveled through the empire making proselytes, taking as his companion a Tyrian courtesan, whom he represented as Helen of Troy, and sometimes as Minerva, calling her at the same time the first intelligence, or mother of all things.

Simonds, Frederic William, American geologist: b. Charlestown, Mass., 3 July 1853. He was graduated from Cornell University in 1875, and was instructor in geology and palæontology there 1875-7. He was professor of geology, zoology, and botany at the University of North Carolina 1877-81, and of geology and biology at the University of Arkansas 1887-90. Since 1895 he has been professor of geology at the University of Texas. He has published the 'Annual Report of the Geological Survey of Arkansas' (1891); 'A Record of the Geology of Texas' for the decade ending 31 Dec. 1896-1900; etc.

Simonides, sī-mŏn'ĭ-dēz, Greek lyric poet: b. Island of Ceos 556; d. about 468 B.C. Invited by Hipparchus, tyrant of Athens, to visit that city, he there met Anacreon and Lasus, Pindar's master. After the death of Hipparchus he proceeded to Thessaly, where he won the favor of the Aleuads and Scopads, whose victories in the games he afterward celebrated. Returning to Athens, in a competition for the best elegy upon those who fell on the field of Marathon, he gained the prize over Æschylus himself. Shortly after this he was invited to the court of Hiero at Syracuse, where he remained till his death at the age of 90. He appears to have been a chief favorite with Hiero in a court adorned by the presence, among others, of Pindar, Bacchylides, and Æschylus. Poetic conception, pathos, and perfect power of expression, in addition to the sweetness which procured for him the surname of Melicertes, are among the chief characteristics of his poetry, though in copiousness, vigor, and originality he was surpassed by Pindar. He brought the elegy and epigram to a high degree of perfection, and in the dithyramb and triumphal ode he particularly distinguished himself. To Simonides belongs the unenviable fame of being the first who took money for his poems. The best editions of his works are Schneidewin's 'Simonidis Cei Carminum Reliquiæ' (1835); and Bergk's (in his 'Poetæ Lyrici Græci').

Simonoseki, sē-mō-nō-sĕk'ē. See SHIMONOSEKI.

Si'mon's Town, Cape Colony, South Africa, on the west coast of False Bay, about 22 miles from Cape Town, has a safe anchorage, and is extensively fortified. There is a large arsenal, dock yards, naval hospitals, and a high school. A railway connects it with the interior. Its position lends it considerable military and commercial importance. It has a salubrious climate. Pop. 3,572.

Sim'onton, Charles H., American jurist: b. Charleston, S. C., 11 July 1829; d. Philadelphia, Pa., 25 April 1904. He was graduated from South Carolina College, studied law, and engaged in practice in his native city. He served in the South Carolina legislature in 1858-86, with the interruptions of the Civil War and the reconstruction. At the outbreak of the war he entered the Confederate army and served until nearly the close of the war, when he was taken prisoner. In 1886-93 he was judge of the United States District Court of his State, after which he was judge of the United States Circuit Court. His publications include: 'Digest of the Equity Decisions, State of South Carolina' (1857); 'The Federal Courts, Organization, Jurisdiction, and Procedure' (1898); etc.

Simony (from 'Simon Magus', Acts viii.), a transation by which something sacred or spiritual is given, or received, for a pecuniary compensation, or a temporal benefit. The nature of Simony is clearly illustrated in the case of Simon Magus, when it was committed for the first time. Simon was a Samarian, noted for his skill in magic. Attracted by the miracles wrought by the preachers of Christianity, he adopted the new faith and was baptized by Philip. Later, Peter and John came to the East to minister to the new converts. «Then laid they their hands on them and they received the Holy Ghost.» When Simon saw this, he offered them money, saying: «Give me also this power.» But Peter said unto him: «Thy money perish with thee, because thou hast thought that the gift of God may be purchased with money.»

Simony, later, assumed many forms, but it always implies an exchange of some material thing or temporal benefit for something spiritual, that concerns God, principally, as purchased office, or preferment in the Church. The degree of this affiliation as well as the disposition of those who are guilty of this sin, account for its several modifications and fall to the province of theologians.

The ecclesiastical penalties imposed for Simony, according to its degree of perversity, are excommunication; reservation of absolution for the culprit to the Pope; suspension of clerics who are guilty of it; restitution of benefices due to it, and the like.

JOHN J. A BECKET.

Simoom', Simoon, or Samun (Arabic, *samma*, «hot» and «poisonous»), a noxious hot wind which blows at the period of the equinoxes in most countries bordering on sandy deserts, especially in certain parts of Asia and Africa, where its temperature has been known to reach as high as 130°. The intense and parching heat, resembling that of an oven, is derived from the hot sands, which, in the deserts of Africa and Arabia, often become heated for a depth of some inches to 200° F. This hot sand is whirled up from the earth by the advancing wind, and

Digitized by Google

the whole air is filled with an extremely subtle and penetrating dust, the effect of which, if breathed freely, is to induce suffocation. The approach of the simoom is heralded by a thin haze along the horizon, which rapidly becomes more and more dense, till it covers the whole face of the heavens. This is followed by fierce gusts of wind, accompanied with clouds of red and burning sand, which are whirled round in rapid gyrations, and so swept onward. Sometimes whole caravans are buried in the masses of sand thus carried along. The simoom generally lasts from 6 to 12 hours and sometimes longer. When the wind blows in squalls death is often very suddenly produced by actual suffocation, and is followed by bleeding at the nose and mouth. Persons exposed to it protect themselves by stopping the mouth and nose with handkerchiefs, and the camels instinctively bury their noses in the sand at its approach. The effects of the simoom are felt in the south of Europe, the hot wind produced in Italy being called the sirocco. In Turkey this wind is called the "*samieli*"; in Guinea and Senegambia a similar wind is called "*harmattan*." See HARMATTAN.

Sim"plicidenta'ta, one of the two divisions of the order of rodents (*Rodentia*), embracing those with only a single pair of upper incisors. It includes all of the rodents except the pikas and hares, which are duplicidentate. See LEPORIDÆ.

Simplicius, sĭm-plĭsh'ĭ-us, a peripatetic philosopher: b. in Cilicia. He was a pupil of Ammonius and Damascius, and taught in Alexandria and Athens during the reign of Justinian. In consequence of the persecutions these philosophers suffered from the decrees of the Christian emperor, seven of them, among whom was Simplicius, sought protection in the court of King Chosroes of Persia. Disappointed in their expectations in the East, they resolved to return, and the Persian king made it one of the articles of a treaty of peace with Justinian, that these philosophers should be exempted from the disqualifications imposed upon all pagans. Among the works of Simplicius are commentaries on Aristotle's 'Categoriæ Physicæ,' 'De Cœlo,' and 'De Anima,' and also one on the 'Enchiridion' of Epictetus.

Simplon, sĭm'plŏn, Fr. săn-plôn (Ital. SEMPIONE, sĕm-pē-ō'nē), Switzerland, a mountain of the Lepontine Alps, 11,117 feet high, in the east of the canton of Valais. The road that passes over it was regarded as one of the most celebrated engineering works of the early part of the 19th century, but is decreasing in importance since the advent of railroads, and the construction of the Simplon tunnel, affording direct communication between Switzerland, France, and Italy. The road commences near Brieg on the Swiss side, and terminates at Domodossola in Piedmont. It was begun in 1800 under the direction of Napoleon, and was completed in 1806. It is 38 miles long, from 25 to 30 feet wide, is carried across 611 bridges, and through a number of great tunnels, rises to the height of 6,578 feet, and has 20 station houses for travelers. The railway tunnel through the mountain from Brieg on the Swiss side to Iselle on the Italian side, was commenced 13 Nov. 1898, and the contract called for its completion in five and one half years, for $13,413,500. It is 20 kilometres, or 12.4 miles, in length, the longest tunnel in the world, and the third, with Mont Cenis and Mont Gotthard, connecting Italy by rail with the adjacent countries. See TUNNELS.

Simplon Tunnel, The, an important work of engineering through the Lepontine Alps, designed to afford a better means of communication between France and Italy. It was commenced in August 1898, and will be nearly 13 miles in length. See TUNNELS.

Simp'son, Edward, American naval officer: b. New York 3 March 1824; d. Washington, D. C., 1 Dec. 1888. He was appointed midshipman in the navy in 1840, was graduated from Annapolis in 1846, and served in the Mexican war on the steamer Vixen. In 1858–62 he was in charge of the department of naval gunnery at the Naval Academy, commandant of midshipmen in 1862–3, and commanded the monitor Passaic in 1863–4, participating in several engagements. He was commissioned commander in 1865; served as fleet-captain of the consolidated Gulf squadron; was present at the fall of Mobile, and received the surrender of the Confederate fleet on Tombigbee River. He became captain in 1870, commodore in 1878, and rear-admiral in 1884. He was retired in 1886, but was president of the United States Naval Institute in 1886–8. He published: 'Ordnance and Naval Gunnery' (1862); 'The Naval Mission to Europe' (1873); 'Report of the Gun Foundry Board' (1885); etc.

Simpson, SIR George, Scottish traveler: b. Loch Broom, Ross-shire, about 1796; d. Lachine, near Montreal, P. Q., 7 Sept. 1860. In 1809–20 he was employed by a London firm in the West India trade, where his ability attracted the attention of the Earl of Selkirk, then head of the Hudson Bay Company, and in 1820 he was appointed to conduct the affairs of the company in America. He united the Hudson Bay Company and the Northwest Company, and became successively governor of the northern department, governor-in-chief of Rupert's Land, and general superintendent of the affairs of the Hudson Bay Company. He planned the expedition of his cousin Thomas Simpson in 1836–9, greatly aided other explorers, and in 1841–2 made the overland journey around the world, claiming to be the first traveler to complete the journey. He was knighted in 1841. He published: 'Narrative of an Overland Journey Around the World During the Years 1841–2' (2 vols. 1847).

Simpson, Matthew, American Methodist bishop and educator: b. Cadiz, Ohio, 11 June 1811; d. Philadelphia, Pa., 18 June 1884. He studied medicine and was admitted to its practice in 1833, but in 1834 closed his office and set out as a Methodist itinerant, filling 33 appointments in six weeks' tours. In 1835 he became pastor of the Liberty Street Church, of Pittsburg, Pa., and in 1837 vice-president of Allegheny College (Meadville, Pa.), and professor there of natural science. He was elected, in 1839, first president of Indiana Asbury (the present De Pauw) University, and undertook his work with three professors and 11 students in the four rooms of a hired building. After a successful administration, he resigned in 1858, and became editor of

Digitized by Google

the 'Western Christian Advocate,' official organ of his Church for the West. In this journal the editor took decided positions on slavery, and other subjects of current discussion. He was elected bishop in 1852; and in 1857, when a delegate to the World's Evangelical Alliance at Berlin, preached in the Garnisonkirche, that being the first instance in which an established church in Prussia had been opened to an English-speaking Evangelical. During the Civil War he was a frequent adviser of President Lincoln. In 1881 he delivered the opening address at the Ecumenical Methodist Conference in London. He was best known for his eloquence, and published a volume of 'Lectures on Preaching' (1879). In his own church he had also a considerable reputation as a parliamentarian and presiding officer. He further published: 'Hundred Years of Methodism' (1876); and 'Cyclopædia of Methodism' (5th rev. ed. 1883). A posthumous collection of sermons was edited by Crooks (1885). Of his orations among the best known is that at the funeral of Lincoln. A statue of him was placed in Philadelphia on the edge of Fairmount Park 2 April 1902. Consult 'Biography' by Crooks (1890).

Simpson College, located at Indianola, Iowa. It was founded in 1867 by the Des Moines Conference of the Methodist Episcopal Church, from which it derives most of its support and patronage. Its organization includes seven departments: (1) college of liberal arts; (2) academy and normal courses; (3) the school of business; (4) the school of shorthand and typewriting; (5) the conservatory of music; (6) the school of oratory; (7) the school of art. A summer school is also maintained. The college department offers three courses, classical, philosophical and scientific, leading to the degrees of bachelor of arts, bachelor of philosophy, and bachelor of science; these courses are all largely elective, the choice of the student being limited to a certain extent by the degree he wishes to obtain. Graduate work is provided for, leading to the degrees of master of arts, master of philosophy, and master of science. Military drill and military science are a part of the curriculum, but are elective, except that drill is required for the men in the first two terms of the freshman year. The academic department offers three courses in preparation for the three college courses; there are two normal courses offered, one of three years, and one of five years, the work of the last two years of the latter course being almost entirely elective. The college is co-educational and there is a dormitory for women on the campus. The students of the different departments maintain a number of literary societies, all of which have their furnished halls. The college athletics are under the control of a joint committee, two members of which are appointed by the faculty, and three by the athletic association. The buildings (1904) were College Hall, Science Hall, Ladies' Hall, the administration building, the gymnasia, and the Conservatory of Music (erected 1902); grounds and buildings were valued at about $675,000; the library contained 3,500 volumes. The productive funds when last reported were $68,342; the annual income was $20,620. The students numbered 772, of whom 110 were in the summer school, and the faculty 39.

Simrock, zĭm'rŏk, **Karl Joseph,** German poet: b. Bonn, Germany, 28 Aug. 1802; d. there 18 July 1876. He studied at the university of his native city and at Berlin, and in 1826 entered the Prussian civil service, which he was later compelled to leave on account of a revolutionary poem which he had written. He translated Shakespeare's poems and some of his plays, and published (with Echtermeyer and Henschel) 'Quellen des Shakspere' (1831). He also published 'Handbuch der deutschen Mythologie' (1853–5); 'Deutsche Volksbücher' (1839–67); 'Heldenbuch' (1843–9), illustrative of the heroic traditions of the Teutonic race, and his own 'Poems' (1844). In 1850 he was appointed professor of old German language and literature at Bonn, a post which he held till his death.

Sims, sĭmz, **George Robert,** English poet and dramatist: b. London 2 Sept. 1847. He was educated at Hanwell College and at Bonn, and since 1874 has been engaged as a journalist and playwright. His publications include: 'Dragonet Ballads' (1879); 'How the Poor Live' (1883); 'Once Upon a Christmas Time' (1898); 'Living London' (1902); etc. His plays include: 'The Lights of London' (1882); 'Two Little Vagabonds'; 'In London Town'; 'Scarlet Sin'; etc.

Sims, James Marion, American surgeon: b. Lancaster County, S. C., 25 Jan. 1813; d. New York 13 Nov. 1883. He was graduated from South Carolina College in 1832; studied medicine at Charleston and at Philadelphia, and in 1835 began to practise. He was settled at Montgomery, Ala., during 1840–53, where he became known for his successful operations for strabismus and club-foot. In 1845 he made known his hypothesis on the cause and proper treatment of *trismus nascentium*. The effectiveness of the treatment was later demonstrated by a long series of experiments. In the same year he began experiments to test a treatment he had conceived for vesico-vaginal fistula, in the course of which he devised the silver suture and several instruments, the chief of which is the duckbill speculum, known as the Sims speculum. In 1853 he removed to New York and shortly began a movement for the establishment of a hospital for the diseases of women. A temporary structure was built in 1855, and a charter and appropriation were granted by the legislature in 1857 for the permanent institution, built in 1866 on the pavilion system. Dr. Sims went to Europe in 1861 and performed the operation for vesico-vaginal fistula in the hospitals of London, Paris, Edinburgh and Dublin. In 1862 he settled in Paris and secured a lucrative practice. From 1864 to 1868 he practised in London, and in the latter year returned to America. He was again in Paris in 1870, and was surgeon-in-chief of an Anglo-American ambulance corps that treated both French and German soldiers after the battle of Sedan. In 1872 he was reappointed a member of the board of surgeons of the Woman's Hospital, but resigned in 1874. Among his published works are 'Clinical Notes on Uterine Surgery' (1865); 'Treatise on Ovariotomy' (1873); 'History of the Discovery of Anæsthesia'; 'The Story of My Life' (1884). A bronze statue of him is in Bryant Park, New York.

Digitized by Google

Sims, Winfield Scott, American inventor: b. New York 6 April 1844. He was graduated at the Newark, N. J., high school in 1861, and served during the Civil War in the 37th New Jersey regiment. After the war he devoted himself to electrical experiments. He constructed an electric motor, which propelled a 16-foot boat at the rate of four miles an hour. He was the first to apply electricity to the propulsion and guidance of movable torpedoes. He also devised a dynamite boat with a speed of 18 miles an hour to be used in harbor and coast defense.

Sims-Dudley Gun. See ORDNANCE.

Sim'son, Robert, Scottish mathematician: b. Ayrshire 14 Oct. 1687; d. Glasgow 1 Oct. 1768. He was educated at the University of Glasgow, where he became professor of mathematics in 1711. By the advice of Halley he directed his private studies to the restoration of the ancient geometers. His first labor in this direction was to restore the Porisms of Euclid. In 1735 he published his 'Sectionum Conicarum Libri Quinque,' a work intended as an introduction to the study of Apollonius of Perga. The next object of his labor was the 'Loci Plani' of Apollonius, which he completed in 1738, but which he did not venture to publish till 1749. The restoration of the elements of Euclid was the great object of Dr. Simson's care, and an edition of the 'Elements' was published in 1756, a work which has always enjoyed a high character both for precision in the definitions and accuracy in the demonstrations. The 'Sectio Determinata' of Apollonius next occupied his attention, but this work was not published till after his death, when it was printed with the 'Porisms of Euclid.'

Simson, Sampson, American philanthropist: b. Danbury, Conn., 1780; d. New York 7 Jan. 1857. He was graduated from Columbia College in 1800, then studied law with Aaron Burr, and was admitted to the bar in 1802. His professional career was brief, and he preferred the leisurely life of a country gentleman in Yonkers, where his estate was extensive. He was founder of the Mount Sinai Hospital of New York, having presented the ground on 28th Street, near 8th Avenue, whereon it was first located as "Jews' Hospital." He also established the still existing "North American Relief Society for Indigent Jews in Jerusalem."

Simultaneous Equations, in mathematics, two equations are simultaneous when the value of the unknown quantities which enter them are the same in both at the same time. A group of equations is simultaneous when the value of the unknown quantities is the same in them all at the same time.

Sin, any thought, word or deed against the law of God. Such is Saint Augustine's definition, but it does not cover Original Sin (q.v.), save in so far as it was Adam's own transgression: in distinction from original sin all other sins are called actual sins. Offenses against purely human law may be crimes, misdemeanors, etc., and the same may be called sins; but a sin is not necessarily a crime, no matter how heinous it may be. For example, the most grievous sins may be sins purely of thought or of desire or intention: of these human law cannot take cognizance, and hence they are not crimes or misdemeanors. Sins are variously classed, namely, as of omission and of commission; as against God, our fellowmen or ourselves; as premeditated and unpremeditated; internal and external; mortal and venial. Regarding these several kinds of sin and classifications of sins, theologians of all schools are in agreement, except the last division, that of mortal and venial. The divines of the Protestant churches in the time of the Reformation, while admitting a difference among sins so that some would be more heinous than others, looked on all sins alike as mortal; that is, deserving everlasting punishment. Thus Calvin writes: "The sins of believers are venial, not because they do not merit death, but because there is no condemnation for those who are in Jesus Christ, their sin not being imputed"; even the daily falls of good men make them "liable to the penalty of death before the judgment seat of God" (Calvin, Inot. Chr. iii. 4). In the doctrine of the Roman Catholic Church it is taught that no one who is in friendship of a holy God is guilty of sins which in their own nature merit eternal death: hence a distinction is drawn between sins mortal and sins venial; mortal sins are against the very end of God's law, which is the love of God, and they deserve everlasting punishment; venial sins, the daily falls of good men, do not annihilate the friendship of the soul with God, and grace is still left whereby the sin may be repaired.

Sin of Joost Avelingh, The, the first work of "Maarten Maartens" (q.v.) (1890) (J. M. W. van de Poorten-Schwartz). This "clever and fascinating study of human motives" at once gained for its author the attention of critics and reading public.

Sinai, sī'nā or sī'nī, Arabia, a mountain peak rising above the rugged surface of the peninsula which projects between the Red Sea and the Gulf of Suez, on one side, and the Gulf of Akaba on the other. This is the sacred mountain of biblical fame, where Moses received the stone tablets containing the Ten Commandments. The series of mountains covering the entire peninsula consists of three distinct mountains, which are known individually as Mounts Serbal, Catharine and Umm Shomer, and also by the general name of Sinai. They are respectively 6,750, 8,540 and 8,000 feet high, and penetrated by narrow, deep valleys and ravines, enclosed by perpendicular walls of rock. The numerous caves were the homes of hermits. The mountains stand out in bold relief. There have been many controversies as to which peak might be the "Mountain of the Law," and Mount Serbal now bears that distinction, after much research. At the foot of Mount Musa stands the convent of Saint Catharine. The rock inscriptions, dating from an early era, are interesting.

Sinaloa, sē-nä-lō'ä, Mexico, a state bounded on the north by Sonora and Chihuahua, on the east by Chihuahua and Durango, on the south by the territory of Tepic and the Pacific Ocean, and on the west by the Gulf of California. Area 33,671 square miles. From the Gulf, the land rises gradually to the Sierra Madre Mountains, the principal range in the state. There are numerous rivers, some of which are navigable. An excellent natural harbor is that of Topolobampo. The district of mines (gold, silver, copper, iron,

Digitized by Google

and lead) is in the east, and the deposits of metals there are regarded as perhaps the most valuable in Mexico; there, also, the climate is cool, frosts occur frequently, and the rainfall is excessive. The low and hot western belt is devoted to agriculture, the chief products being cereals, cotton, tobacco, sugarcane, coffee, and fruits. These crops are said to yield about $8,000,000 annually, and the cattle industry about $9,000,000 (value of Mexican silver "dollar," $0.392). The two customs ports are Altata and Mazatlán. Exports are valued at $5,000,000 approximately, and imports $6,000,000. Interior communication is furnished by the Western Mexican, or Sinaloa and Durango Railway, and by good wagon-roads; communication with other coast states and foreign countries, by the Pacific Mail, Mexican International, and other steamship lines. The capital of the state is Culiacán Rosales, a town of 10,487 inhabitants, connected by rail with the port of Altata; it has a government palace, cathedral, mint, cotton mills, etc. The largest city in the state, and the chief Pacific port of the republic, is Mazatlán (pop. 15,852), which is built on a small peninsula opposite Olas Atlas Bay. Total population of the state, 296,109. Compare 'Mexico, a Geographical Sketch,' (Washington 1900).

MARRION WILCOX,
Authority on Latin-America.

Sinait'ic Manuscript. See BIBLE.

Sincaline. See NEURINE.

Sincere Brethren. See RELIGIOUS SECTS.

Sincerity, Order of. See ORDERS, ROYAL.

Sinclair, sĭn'klăr or sĭn-klăr', or **Saint Clair, Family of.** The name is of Norman origin, and was first borne in Britain by Walderne, Count de Santo Claro, who accompanied the Conqueror into England. The son of this count settled in Scotland in the reign of David I., receiving from that monarch a grant of the barony of Roslin. His descendants obtained also the earldoms of Orkney and Caithness. Another branch of the family, the Sinclairs of Hermanston, derive their descent from Henry de Santo Claro, *vicecomes* of Richard de Morville, chancellor of Scotland, from whom he obtained in 1162 a charter of the lands of Hermanston. Sir Henry Saint Clair of Roslin swore fealty to Edward I. of England, but gave his adherence to Robert Bruce, from whom in 1317 he obtained a grant of land in the moor of Pentland. Sir William, his son, married Isabel of Strathearn, Caithness, and Orkney, and by this means the earldom of Orkney came into the family. William, the third earl, was one of the most powerful noblemen in the kingdom. In 1446 he founded Roslin chapel, one of the chief architectural beauties of Scotland. He was high chancellor of Scotland from 1454-8, and also admiral of Scotland. For resigning his claim to the lordship of Nithsdale he obtained a grant of the earldom of Caithness 28 Aug. 1455. In 1470 the earldom of Orkney and the lordship of Shetland were purchased by the king from the Sinclairs, in lieu of which they were granted the castle of Ravenscraig at Dysart, in Fife, with several lands adjoining. He is now styled Earl of Caithness and Lord Sinclair. His daughter, Catharine married the Duke of Albany, second son of James II. His eldest son William received the barony of Newburgh, Aberdeenshire; his second son, Sir Oliver, received all his lands south of the Tay; and to his third son, also named William, he conveyed the earldom of Caithness.

Barons Sinclair.— Sir Oliver Sinclair relinquished to his eldest brother, William, the lands of Cowsland, Midlothian, with the barony of Dysart and adjacent lands in Fife for the title to the barony of Roslin. Henry, a son of the latter, was created Lord Sinclair in 1489, falling at the battle of Flodden 9 Sept. 1513. The third lord was a supporter of the Reformation. The seventh lord, having no male issue, and his daughter Catherine having married John Saint Clair, younger of Hermanston (the family already alluded to), the son of this marriage became eighth Lord Sinclair. Thus the title went to the Sinclairs of Hermanston, who have retained it.

Sinclairs of Roslin.— The above-mentioned Sir Oliver, son of the third earl of Orkney, had five sons, of whom the third, Sir Oliver, was the celebrated favorite of James V., who had command of the Scottish army at the rout of Solway Moss in 1542. His fourth son became Dean of Restalrig. The last of Sir Oliver's line sold the estates of Roslin to one of the sons of the eighth Lord Sinclair, and these estates, together with those of Dysart were inherited by the eighth lord's second grandson, Sir James Saint Clair Erskine of Alva, succeeded his uncle as second Earl of Rosslyn in 1805.

Earls of Caithness.— This title, conferred on William Sinclair, third earl of Orkney, was inherited by his second son, William. From him the branch of the family which now enjoys the title is remotely descended. The sixth Earl of Caithness, being deeply involved in debt, executed in 1672 a deposition in favor of Sir John Campbell of Glenorchy, his principal creditor, who was created Earl of Caithness in 1677, after the decease of this earl. He was ultimately obliged to relinquish the title in favor of George Sinclair of Keiss, a grandson of the fifth earl of Caithness. The Sinclairs of Ulster, from whom came Sir John Sinclair (q.v.), are a branch of the noble house of Caithness.

Other branches of the Sinclair family include the Sinclairs of Dunbeath, Inverness-shire, of Longformacus, Berwickshire, and of Stevenston, East Lothian.

Sinclair, SIR **John,** Scottish author and agriculturist: b. Thurso Castle, Caithness, Scotland, 10 May 1754; d. Edinburgh 31 Dec. 1835. He was educated at the universities of Edinburgh, Glasgow and Oxford, was called to the bar in 1775, but did not engage in practice. He was elected to Parliament in 1780, served with brief interruptions until 1811, and in 1786 was created a baronet. He took an active share in building up the fisheries and in promoting agricultural interests, founded the Scottish Society of Wool Growers in 1791, and the Board of Agriculture in 1793, acting as the first president of both associations, and in that capacity maintained an extensive correspondence with Gen. Washington. The most remarkable work of his life was the compiling of the stupendous 'Statistical Account of Scotland, drawn up from the Communications of the Ministers of the Different Parishes' (21 vols. 1791-9). His other

Digitized by Google

publications include 367 pamphlets and 18 other volumes, among which are: 'History of the Public Revenue of the British Empire' (3 vols. 1785–9); 'Code of Health and Longevity' (4 vols. 1807); 'Code of Agriculture' (1819); etc.

Sinclair, William Macdonald, English Anglican clergyman: b. Leeds 3 June 1850. He was educated at Balliol College, Oxford, took holy orders, is examining chaplain to the bishop of London, honorary chaplain to the king, and since 1889 has been archdeacon of London and canon of Saint Paul's. He has written: 'The Psalms in the Original Rhythm' (1879); 'Lessons on the Gospel of Saint John' (1882); 'Christ and Our Times' (1894); 'The Churches and the East' (1898); 'The Church and the Nonconformists' (1902); 'The Authority of Sunday' (1903); etc.

Sind, Sindh, or **Scinde** (From *sindhu*, a collection of waters), British India, an extensive territory and division of the province of Bombay, comprising the lower course and delta of the Indus, and bounded on the west and northwest by Baluchistan and Afghanistan; northeast by the Punjab; east by Rajputana; and south by the Rann of Cutch and the Indian Ocean; length, north to south, about 380 miles; greatest breadth, east to west, 280 miles; area, estimated at 53,898 square miles. The capital is Hyderabad, the chief port Karáchi, connected by rail. The seacoast, except at the western extremity (Cape Monza), is very low, being composed of mud-banks deposited from the rivers of the delta, or of low hills of sand blown in from the beach, the whole shore being a dreary swamp, destitute of trees or shrubs, and submerged at spring tides. In the dry season the stiff clay soil, which is strongly impregnated with nitre, bears an abundant crop of gigantic grass, with furze, mimosas, and cacti, and affords pasture to numerous herds of buffaloes. West of the Indus the Hala Mountains approach the river at Sihwan, and come close to the sea at Cape Monza; and between the former place and Karáchi, on the northwest mouth of the Indus, is a maze of hills, the highest of which reach an elevation of about 1,500 feet, terminating abruptly on the west bank of the stream. The general appearance of Sind is that of a jungly wilderness; spontaneous vegetation takes the place of cultivation.

The climate is dry and sultry, the country being seldom visited by rain. The mean temperature of summer at Sakkar in the extreme north is about 102.4 F. In the upper districts frost is not unknown, and the heat often varies in the 24 hours from 40° to 84° F. The hot season lasts from March to September, the cold from October to March; and the changes from the one to the other are so rapid, that spring and autumn are not experienced. The exhalations, caused by the evaporation during summer from the stagnant waters and rank decayed vegetation, are extremely injurious to health.

Agriculture is still in a primitive state. In those parts that are under tillage the land yields two crops annually; the spring crop consisting of wheat, barley, millet, sesamum and other oilseeds, hemp, opium, and tobacco; the autumn crop of rice, maize, cotton, sugar, and indigo. Rice, wheat, and maize form the principal staples, being both extensively used for food and exported. Pulse, pumpkins, and other succulent plants are raised, and the date, mango, plantain, pomegranate, lime, citron, tamarind, fig, mulberry, pistachio, melon, grape, etc., are among the principal fruits. In moist situations gigantic grasses abound. The wild animals include the tiger, panther, hyena, jackal, wolf, fox, antelope, and other kinds of deer, wild ass, wild hog, etc. The domestic animals include camels, buffaloes, horses, sheep, and goats. The camels are valuable, both as beasts of burden and as furnishing a rich milk, and hair for shawls and cloths; the buffaloes are prized for their hides, flesh, and milk, of which last *ghee* is made, which is an important article of traffic in Indian commerce. Birds are in great variety. Fish form a chief part of the food of the poorer people. Venomous snakes, scorpions, and centipedes are common.

The Sindians, a mixed race of Jats and Baluchis, are partly of the Hindu and partly of the Mohammedan faith. They are well made, and handsome; tall, inclined to corpulence, and of dark complexion; the women are noted for their beauty. The moral character of the people is low. The language differs little from the pure Hindi of Upper India, though more regular and complete in the inflexions of its nouns and verbs. Baluchi is also much spoken, especially in the districts west of the Indus; and Persian may be considered as the language of the higher orders. The natives are very ingenious as weavers, turners, and artisans, and are specially noted for their skill in the production of wooden lacquer work, famed throughout India. The leading textile fabrics are coarse silk, cotton, or mixed cloths. The coarse silk goods are woven from silk imported from China and Persia. Sind imports British manufactured goods, sugar, groceries and spices, raw silk, etc. Its exports, principally its own productions, comprise rice and other grains, ghee, indigo, potash, dried fish, wool, hides, etc. There is a transit trade with the Punjab, Persia, and Afghanistan, which has been improved by the Indus Valley railway. The harbor of Karáchi has been improved at considerable expense, and trade is increasing.

Sind was governed by Hindu rajas at the time of its invasion by Alexander the Great, but subsequently, after many changes, it became an independent state. It was finally subdued by the Emperor Akbar in 1580, since which period it has always been either nominally or really tributary. In 1739 it fell under the power of Nadir Shah, but on his death it reverted to the imperial sway of Delhi. It was, in 1756, presented by the Mogul court as a dowry to Timur Shah Derani, king of Kabul, to which country it was down to its annexation to British India deemed subordinate. The country, however, was, during the whole of the 18th and the early part of the 19th century, a scene of almost constant civil dissension, caused by disputes between the two leading tribes of Baluchis, which led at last to the elevation of the Talpur dynasty of the 'Amirs.' The government under these Amirs was a wholly unchecked military despotism, upheld by a feudal soldiery, supported by their respective chieftains, and estimated to have numbered about 102,000 men. The hostility displayed by the Amirs of Sind against the British, during and after the operations against the Afghans, led ultimately to its invasion by

Digitized by Google

British troops, and final conquest by Sir C. Napier's victory at Miani, 17 Feb. 1843. It was soon after annexed to the presidency of Bombay. Pop. about 3,500,000.

Sindhia's (sĭn'dĭ-az) **Dominion,** or **Gwalior,** India, a Mahratta state, forming part of the Central India Agency. It is of irregular form, about 420 miles long from northeast to southwest, and has an area of 25,041 square miles. The main portion forming the Gwalior assistant agency, lies between Rajputana and the United Provinces; other portions are contained in the Indor Residency, and the Bhopal, West Malwa, Bhopawar, and Guna assistant agencies, between the Central Provinces and Rajputana. The surface is mostly undulating, with a general slope to the north, where it comprises a part of the great plain of the river Jamna; in the south, portions of it are traversed by the Vindhya Mountains. The Chamba partly bounds it on the northwest; other rivers are the Sind, Betwah, Dussam, etc., tributaries to the Jamna with their affluents, having mostly a northern course; south of the mountains the Narbada carries part of the drainage to the west. The soil is generally of high fertility; opium-poppy is an important staple of culture, and an abundance of corn and oleaginous plants, sugar-cane, barley and pease on the dry lands in winter, cotton and tobacco, are raised. The population are mostly Mahrattas, but include also Bhils, Minas, and Coolies, numerous Brahmans, a few Rajputs, and a peculiar sect of Mohammedans called *Bhoras*, who are supposed to be of Jewish origin. The chief towns are Gwalior (the capital), Ujjain, and Mandesur. This state was founded after the successes obtained by the Mahrattas over the Mogul forces in 1738, by Sindhia, a chief who raised himself from obscurity by his own merits. He died in 1754. In 1781 Madaji Sindhia negotiated a peace between the British and the Mahrattas, and having introduced European discipline and tactics into his army, possessed himself of Delhi, Agra, and the person of the Mogul emperor, in whose name he subsequently acted. He was the most powerful member of the Mahratta confederacy. His successor Dowlat Rao Sindhia was defeated by Wellington at Assaye, and at Delhi and Laswari by Lord Lake. After his death in 1827 the state became disorganized, and order was only restored after the battles of Maharajpur and Pennair (1843), in which the British troops were victorious. The state was then constituted subsidiary to the British government. At that time the subsequent chief, Ali Jah Jaiaji Rao Sindhia, was a minor. He was loyal during the mutiny of 1857. In 1877 he was made a G.C.B., and in 1878 was invested with the Star of India. At his death in 1886 he was succeeded by his son Madho Rao. Pop. about 3,200,000.

Sine, in mathematics, one of the most commonly used trigonometrical ratios of an angle. With the usual notation it is the ratio of the perpendicular to the hypotenuse. The sine of an arc is the sine of the angle subtended by the arc. In plane triangles the sides are to each other as the sines of the opposite angles; in spherical angles, the sines of the sides are to each other as the sines of the opposite angles. Hence it appears how important the sine is for finding certain parts of triangles, from certain given parts.

Si'necure, strictly speaking, an office which has no work attached to it, but generally applied to a political office with liberal salary, and comparatively little to do. In the United States no office is supposed to be absolutely free from actual service on the part of the incumbent, but sinecure offices were formerly very numerous in the English public service. They were used to enrich ministers of state and their families; Sir R. Walpole, for example, presented his son Horace to three or four sinecure places which brought him in a large income. The number of such places has been greatly diminished by modern reforms; the stewardship of the Chiltern Hundreds and some other offices of merely nominal profit are retained, because by accepting one of them a member of the House of Commons is enabled to vacate his seat.

Sing Sing, N. Y. See OSSINING, N. Y.

Singan-fu, sē-ngän'foo, China, the capital of the province of Shen-si, near the centre of the province, a few miles south of the Wei-ho River. It lies on one of the principal commercial roads of the empire, and at the head of navigation for large junks on the river. The city is surrounded by well-preserved walls, and contains many objects of historic interest. During the 12th century B.C. it was the capital of China, and the Chinese court retired to this city when the allied Powers occupied Peking in 1900. For additional information see SIAN-FU.

Singapore, sĭng-ga-pōr', East India, a British possession consisting of a small island and a strongly fortified seaport city, the capital of the crown colony of the Straits Settlements, off the southern extremity of the Malay Peninsula, commanding the eastern entrance to Malacca Strait, the chief route to the Far East.

The town is well-built, has a sea frontage of about six miles, and a fine harbor with extensive docks and wharves. It has become the commercial entrepôt of southern Asia and the Indian Archipelago, and carries on such extensive transactions that it has been termed «the Liverpool of the East.» The port is free to vessels of all kinds and nations, without charges on exports and imports, anchorage, etc., only light dues being payable. Singapore is a coaling station of the British navy, and is defended by forts carrying heavy ordnance, and by submarine mines. The imports from Great Britain comprise cottons (the largest import), iron, machinery, coals, hardware, and various manufactures; the exports thither consist of tin, coffee, rice, sugar, nutmegs, mace, sago, tapioca, catechu, gambier, hides, rattans, gutta-percha, and numerous sundries. The imports from the continent of Europe and the United States consist of wines, spirits, and liquors, manufactured goods, provisions, etc., in exchange for similar commodities to those sent to Britain. Singapore also carries on an extensive trade with Calcutta, Madras, and Bombay. The annual value of exports from and imports into Singapore, taken together, is as much as from $200,000,000 to $250,000,000. A railway has been constructed from Singapore to Kranji, on the Johore Straits.

Digitized by Google

The town is well supplied with water, but in other respects its sanitary arrangements are somewhat backward.

The island of Singapore is of rhomboidal shape, about 27 miles long and 14 miles broad; area, 206 square miles. It is separated from the mainland by a narrow strait two miles to one half a mile in breadth. Its surface is generally undulating, rising in some parts into round verdure-clad hills, the highest of which called Bukit-Tima or the Tin-hill, rises 520 feet above the sea. Tin smelting is the chief of the settlement's industries, more than half of the world's tin product coming from the smelting works of Pulan Brani. The fisheries also are very productive and give employment to a large number of people. The chief cultivated plants include coffee, pineapples, and other fruits, cocoanuts, aloes, gambier, pepper, indigo, sugarcane, etc. Fruits and vegetables are grown in immense variety and to great perfection. The British settlement dates from 1819 when permission was obtained to build a factory on the southern shore of the island. By treaty in 1824 they purchased for 60,000 Spanish dollars and a life annuity to the Sultan of Johore and his resident officer of 24,000 dollars, the sovereignty and fee simple of the island, as well as of all the seas, straits, and islands to the extent of 10 geographical miles (11½ miles) around. Pop. about 235,000 (mostly in the town), including about 3,000 whites. See Straits Settlements.

Singer, Isaac Merritt, American inventor: b. Oswego, N. Y., 27 Oct. 1811; d. Torquay, England, 23 July 1875. He was a machinist, and having spent years of study on the improvement of sewing machines obtained a patent on a single-thread, chain-stitch machine. He established a factory in conjunction with Edward Clark, a wealthy lawyer, and made a fortune in the manufacture of machines which bore his name. He resided at Paris and Torquay during the later years of his life.

Singhalese, sĭn-gạ-lēz' or -lēs', or properly **Sinhalese, Language,** the speech of 70 per cent of the native inhabitants of Ceylon. It is an Aryan tongue and nearly allied to Pali, the sacred language of the Buddhists. There is a material difference between the vernacular and the written language, which latter has a copious vocabulary and a regular grammar, and is capable of elegant style. Its alphabet has 50 letters, but these represent only 30 sounds (7 vowels, 23 consonants), belonging to the Singhalese; the other sounds are heard only in Sanskrit words or are indistinguishable. In the Singhalese words occurring in the following illustrations of the grammar of the language the vowels have the values they have in Italian, the consonants, including *ch, sh* and *j* have the sounds given to them in English, except that *g* is always hard, and that the diphonics *chh, jh, th, dh, ph* and *bh* stand for sounds peculiar to Singhalese. In Singhalese grammar there are three genders; nouns masculine end mostly in *a*, plural *o, an, aru;* feminine in *i*, plural *u, varu;* neuter in *a, u,* plural adding *val,* or dropping the final syllable: *nuvara,* city, *nuvaraval,* cities; *kaduva,* sword, *kadu,* swords. The principal case endings, masculine and feminine, are: genitive, *ge, ne;* dative, *ta, da;* accusative, *va;* ablative, *gen, nen*. The neuter endings of the above four cases respectively are, *ē, ata, ava, en;* examples *manuspaya* (Lat. *homo*), man; *gūnī* (Lat. *mulier*), woman; *oluva* (Lat. *caput*), head; genitive *manuspayāge, hominis; gūnīgē, mulieris; oluvaē, capitis;* dative, *manuspayā, homini,* etc.; accusative, *gūnīva, mulierem,* etc.; ablative, *oluven, capite,* etc., as above detailed: plural, *manuspayo, homines; olu, capita; manuspayinnē, hominum,* etc. The adjectives are indeclinable. There are no less than 14 different pronouns of the second person, the use of them being regulated by the rank, both of the speaker and the person addressed. The Singhalese literature comprises several original poems of some merit, and an extensive and interesting series of native chronicles.

Singhara Nut, the fruit of a floating aquatic plant *Trapa bispinosa*. The nut is large, about three quarters of an inch thick, having normally four spines, two of which are often absent. It has a sweet starchy kernel, which is a staple food of the natives of Cashmere.

Singing. See Voice and Voice Culture.

Single Standard. See Bimetallism.

Single Tax, a tax levied upon the value of land, irrespective of the value of improvements, and so regulated as to equal the economic rent, or «unearned increment,» of land. (See Political Economy.) By taking the full rent of land, the government would in effect assume the ownership and become sole landlord. The primary principles of the single tax were enunciated by the Physiocrats, French political economists of the 18th century (see Physiocratic School); but Henry George (q.v.) was the first to fully develop the theory in his ‹Progress and Poverty› (published 1879), which made the question of the single tax an issue in modern politics and political economy. Accepting the «classic» law of rent, that «the rent of land is determined by the excess of its produce over that which the same application can secure from the least productive land in use,» he derives as the law of wages that «wages depend upon the margin of production or upon the produce which labor can obtain at the highest point of natural productiveness open to it without payment of rent,» and as the law of interest that «the relation between wages and interest is determined by the average power of increase which attaches to capital; as rent rises interest will fall as wages fall, that is, will be determined by the margin of cultivation.» Thus the economic basis of the single tax theory is that wages and interest in the last analysis are determined not by the productiveness of labor and capital, but by the value of land, and that as land becomes more valuable (that is, the economic rent greater), wages and interest will become relatively less. Therefore the only way to prevent the landowners alone from reaping the benefit of increase in the value of land to the detriment of labor and capital, is to make land common property; and this is best accomplished by society's appropriating all rent in the form of taxation, and thus obtaining for society the full benefit of increase in land values. The single tax is also defended on the grounds of justice, and expediency as a method of taxation. (1) From

Digitized by Google

Digitized by Google

1. Street Scene in Singapore. 2. Malay Court of Justice, Singapore.

Digitized by Google

the point of view of justice, the right of private ownership is given by labor only, and as land is in no way a product of man's labor, it should not properly be owned by individuals, but equally shared in by all, and as the value of land, according to the law of rent, is not absolute, but relative to the best land which may be had for the using; and the increase in value depends upon increase in population and general improvement in the arts and sciences, this increase in value should properly belong to society, as not the result of any individual's labor. (2) As a method of taxation the single tax has the advantage of not bearing upon production because the value of land is not a product of any man's labor, but rather makes speculative rent impossible and the holding of land not in use unprofitable, so more land would be thrown open to the use of producers; another advantage is that such a tax can be easily collected, for land cannot be concealed, but the value can be easily ascertained, and with the assessment once made comparatively few officials would be necessary to collect this one tax; and also it bears equally on all, for it takes for the community what is the creation of the community. The benefits to society claimed for the single tax are as follows: (1) It would stimulate production by removing all hampering taxes from productive industries, and, as has been said, by preventing the holding of land for speculation, not for use; (2) that the distribution of wealth would be more equal, because the natural increase in the value of land resulting from natural laws would be taken by the community and would be shared in by all, and the unnatural increase in value caused by private monopoly and speculation would be prevented; (3) it would finally result in the increase of social wealth so that want would be abolished, and an advance in civilization made possible which is impossible under present conditions.

Objections to the Theory.— The objections to the single tax come from two parties: (1) those who believe in private property in land; (2) the Socialists, who claim the single tax is only a half way measure. By the conservative element the arguments are advanced: (1) that the single tax is based on a false idea of justice, because landowners have purchased land with the results of their labor and have as much right to their property as if they had put the results of their labor into some other form of property; that therefore the single tax upon land values would practically distinguish between forms of labor, and would therefore be unjust, and, from an economic point of view inexpedient; (2) that the single tax is impractical because it would not raise sufficient revenue; (3) that the sense of private property in land was the very beginning of civilization, and has always been a great civilizing influence, "the keystone of society," and to practically destroy this would be to weaken the very foundations of society. The Socialists, on the other hand, claim (1) that landowner and capitalist unite to oppress the laborer and rob him of the full produce of his labor, and that both land and capital should be the property of society; (2) that the same argument of justice which applies to society's taking control of the land, may be applied to taking control of capital at the present state of civilization, since the machinery and immense establishments of the present day are really not the product of the labor of any individual, or of a few; (3) and that therefore the single tax would be at best only half a solution of the problem, and would not greatly benefit the working class.

The Single Tax Movement.— The principles of 'Progress and Poverty' were slow in gaining adherents in the United States; but George continued writing and enforcing his views with such vigor and sincerity that he aroused the interest and enthusiasm of many political reformers, and a considerable body of workingmen. The first and most important political contest in which the Single Taxers engaged was in New York in 1886, when George was nominated for mayor by the United Labor party on a single tax and labor platform, and received a large number of votes. Local single tax leagues and clubs were organized in many States, and many large cities; the National Single Tax League met at New York in 1890 and adopted a full declaration of principles prepared by George himself. Since George's death in 1897 the single tax movement has lost in numbers of its adherents, and in political influence. Many of the single tax organizations persist, and are centres of propaganda by means of public discussions and the dissemination of literature. The 'Single Tax Review' is published in New York by Joseph Dana Miller in the interests of the movement. In 1896 a single tax community was established at Fairhope, Ala., by an association of five men, the number having increased to 65 in 1903. The distinctive feature of the colony's policy is of course its system of land tenure. The association owns 1,200 acres of land, including the village site, on the beach, and back to farm lands in the rear. Not a foot of this land has been or will be sold. Holdings are rented on a 99-year lease. This eliminates land speculation from the first, there being no inducement to rent and hold land from which there is no opportunity to make a profit by selling when values have increased. A man who has improved his land may sell the improvements, but he does not sell the land. The rents are based on the advantages of location, and range from 20 cents an acre per year for farm lands in the rear to $25 for business lots in the centre of the village. From the rentals the association pays first all the State taxes of all tenants, except those on moneys and credits. The remainder is applied to the expense of conducting the colony and to furnish better roads, schools and all sorts of public service than the colony would otherwise get. The community runs its wharf, steamer, and waterworks. Dissatisfaction and complaints have arisen at times, but the association has been able to meet them in such a way that the colony has grown.

Consult: George, 'Progress and Poverty,' 'The Land Question'; 'Social Problems'; Miller, 'Progress and Robbery'; Seligman, 'Essays in Taxation'; Simons, 'Single Tax vs. Socialism'; Smart, 'Taxation of Land Values and the Single Tax.'

A. M. Burnham, A.B.,
Editorial Staff, 'Encyclopedia Americana.'

Sinjirli, sĭn-jėr'lē, Asiatic Turkey, a village in the vilayet of Aleppo, at the foot of Mount

Digitized by Google

Amanus or Giaour Dagh, 30 miles northeast of Alexandretta, ancient Iskanderun, on the Mediterranean. It is noted as the site of an ancient Hittite city, excavated under the auspices of the German Orient-Gesellschaft since 1888. The two encircling city walls and the acropolis with three lines of fortifications were disclosed, and numerous Aramaic inscriptions of great historical value were discovered. One of the most important finds, now in the Berlin Museum, was a stele commemorating the victory of Esarhaddon, king of Assyria, in Tammuz (June) 670 B.C., over Tirhakah, king of the Egyptians, who is represented as a negro. Consult: Lidzbarski, 'Nordsemitische Epigraphik' (1898); Müller, 'The Contemporary Review' (1894).

Sinking Fund. See DEBT, NATIONAL; FINANCE.

Sin'nett, Alfred Percy, English journalist and theosophist: b. 18 Jan. 1840. After study at the London University School, he became connected (1859) with the *Globe* newspaper, later was sub-editor and "leader" writer for various dailies in London, and in 1865–8 was at Hong Kong, as editor of the *Press*. On his return he became an editor of the *Standard*, took editorial charge of the 'Pioneer of India,' and becoming identified with the Theosophical movement, was made president of the London branch of the society, and wrote: 'The Occult World' (1881); 'Esoteric Buddhism' (1883); 'The Growth of the Soul' (1896).

Si'non, a character in the Trojan war-story of post-Homeric origin. According to Virgil, he was a follower of Ulysses, allowed himself to be taken prisoner by the Trojans, and persuaded them to drag the colossal wooden horse into their city. Within this structure were concealed all the leading warriors of the Greek army. The night following the admission of the horse Sinon gave the signal to the besiegers by lighting a beacon, released the heroes from the horse, in which they were imprisoned, and thus brought about the sack of Troy.

Sinope, sĭ-nō'pē (Turkish, SINÛB), Asiatic Turkey, a seaport city, capital of a sanjak, situated on the neck of land connecting the rocky peninsula of Cape Sinope, in the Black Sea, with the mainland, 350 miles east-northeast of Constantinople. It is enclosed by a wall flanked with towers and defended by a castle and several forts, and is built to a considerable extent out of the ruins of an ancient Greek city. Its harbor is the best on the south shores of the Black Sea, and it has a naval arsenal and a building yard, at which many vessels are built. On 30 Nov. 1853, 18 Russian ships here attacked and destroyed a Turkish flotilla consisting of six frigates, three corvettes, and two steamers, manned by about 4,000 men. Sinope is a place of great antiquity. It was the birthplace of Diogenes and the capital of Mithridates the Great. Pop. about 10,000.

Sinûb, sē-noob'. See SINOPE.

Si'nus, in anatomy, a cavity of bone or other tissue, especially an air cavity, such as those in the interior of certain bones, the frontal, ethmoid, sphenoid, temporal, superior maxillary, etc. The frontal sinuses are two irregular cavities extending upward and outward from their openings on each side of the nasal spine, between the inner and outer tables of the skull, and separated from one another by a thin bony septum. They give rise to the prominences above the root of the nose called the superciliary ridges. They are not fully developed till after puberty, and vary considerably in size, being usually larger in men than in women and young persons. When very much developed they give a receding appearance to the forehead. They communicate on each side of the upper part of the nostril by a funnel-shaped opening, which transmits a prolongation of mucous membrane to line their interior. These sinuses are much more highly developed in certain mammals and birds than in man. They extend backward over the top of the skull in the ruminant and some other quadrupeds, and penetrate the cores of the horns in oxen, sheep, and a few antelopes. The most remarkable development of air sinuses in the mammalian class is presented by the elephant; the intellectual physiognomy of this huge quadruped being caused, as in the owl, not by the actual capacity of the brain case, but by the enormous extent of the pneumatic cellular structure between the outer and inner plates of the skull. The sphenoidal sinuses are two large irregular cavities, formed, after the period of childhood, in the body of the sphenoid bone. They communicate with the upper part of the nose, from which they receive a layer of mucous membrane. Like the frontal sinuses, they serve to lessen the weight of the skull and to add to the resonance of the voice. The ethmoid sinuses lie in the lateral masses of the ethmoid bone. They communicate with the cavities of the nose. Their main use is to diminish the weight of the fore part of the skull. That part of the temporal bone which forms the projection behind the ear is termed the mastoid process. The interior of this process is hollowed out with air sinuses which communicate with the tympanum or middle ear, and through it with the nose. The superior maxillary sinus is the largest of the sinuses, and the only one present in the infantile skull. The term sinus is also applied to certain channels for the transmission of venous blood.

Sion. See ZION.

Siouan, a designation derived from the word "Sioux," and applied to the linguistic stock or family to which the Sioux Indians belong. The Sioux call themselves Dakota, or Lakota, and the name "Sioux," given to them by the whites, is said to be derived from an Algonquin word signifying the "snake-like ones," or enemies, a term which their crafty methods of warfare would seem to justify. The family of tribes, of which the Sioux are the best known to Americans of the present day, includes, as principal divisions, the Dakotas or Sioux in the United States, and the Assiniboins in British North America, although both Sioux and Assiniboins occasionally cross the border into adjoining territory. The Sioux division embraces the subtribes of Santee, Sisseton, Wahpeton, Yankton, Yanktonnai and Teton, and the last mentioned, whose name means "dwellers on the prairie," are again subdivided into the Brulé Sioux, the Sans Arcs, Blackfeet, Ogalalla, Minneconjou, Onopaw and Unkpapa. To the Sioux nation also belong or belonged the sub-tribes of Omaha, Quapaw or Arkansa, Ponca, Osage and Kansa,

Digitized by Google

Iowa, Oto and Missouri; also Winnebago, Mandan, Minnetaree or Gros Ventres (which last named includes the Crow Indians), Tutelo, Biloxi, Catawba (or Flathead), Eutaw, Chickoree, Natchez and others, and the Mannahoak, Monacau and other tribes, which came into contact with the pioneers of Virginia and North and South Carolina, and are now extinct or represented by insignificant remnants.

The Siouan tribes of the East which were not crushed out in conflict with the early settlers retreated gradually to the Northwest, and made their final stand in that region against advancing civilization. The battle known as the Custer massacre (25 June 1876) was the last important military event of the long conflict, and it was followed by such energetic measures on the part of the United States that organized resistance by the Sioux to the National authority was finally terminated. Sitting Bull, the last of the great Indian chieftains who rose above the level of marauders, and were actuated by a sincerely patriotic spirit in their resistance to white aggression, was killed on 15 Dec. 1890 by Indians in the service of the government. The sundance and other barbarous ceremonies have been suppressed, and the virtual extinction of the buffalo has made it necessary for the Sioux either to adopt the methods of civilization in obtaining a living or depend on government rations for support. See INDIANS, AMERICAN.

Sioux (soo) **City**, Iowa, city, county-seat of Woodbury County; on the Missouri River at the mouth of the Big Sioux, and on the Great Northern, the Chicago, M. & St. P., the Chicago, St. P., M. & O., the Sioux City & P., and the Illinois Central R.R.'s; about 100 miles north by west of Council Bluffs. It has steamer connection with the Missouri River ports, and trolley connection with suburban villages. It is the commercial and industrial centre of northwestern Iowa, northeastern Nebraska, and the southeastern part of South Dakota. The residence portion is on the high bluffs from which may be obtained views of the Missouri and the valley for miles.

The city was settled in 1849 by traders, and for several years it was the place where gold seekers going to the Black Hills were fitted with all necessary material for mining and for camp life. It was a government post in the years when there were frequent troubles with the Indians in Nebraska and Dakota. The city was brought into prominence and much advertised by its «Corn Palaces»; five were built in successive years, and annual fairs and festivals were held in them, usually of a month's duration. The buildings were as beautiful as unique; they were ornamented with corn, grains, and grasses, the products of the State, arranged artistically and in such a manner as best to show the fertility of the soil of the State. Instead of the «Palaces,» interstate fairs are now held annually at Riverside Park, one of the beautiful suburbs.

The government census of 1909 gives 136 manufacturing establishments, which had invested capital to the amount of $13,603,000. There were employed in the manufactories 4,645 persons, whose annual wages amounted to $3,069,000; the raw material cost $30,388,000, and the annual value of the products was $37,424,000. There are several large meat packing houses in which thousands of hogs, sheep, and cattle are slaughtered and packed each day. Other industrial establishments are flour mills, broom and furniture factories, stove and engine works, agricultural implement works, clothing shops, shoe factory, carriage and wagon works, soap and starch factories, tile works, and creameries. There are also large grain elevators, stock and lumber yards, and a number of merchandise wholesale houses. The products shipped are chiefly flour, packed meats, grain, and the manufactures of the city.

The principal public buildings are the government building, which cost $250,000; the Union depot, cost $600,000; Y. M. C. A. building, $60,000; public library, $80,000; police building, $30,000; a county court-house, city hospital, Saint Joseph's Hospital, city-hall, and a number of the business blocks. The waterworks cost originally $1,000,000. There are elevated and surface street cars, an excellent system of sewerage, and a large amount of municipal improvements in the street lighting and street paving departments. There are about 50 church buildings.

The educational institutions are a public school high school (the building cost $130,000); Morningside College (M. E.), opened in 1890; Brown's Business College, public and parish elementary schools, and the large public library. The 17 banks have a combined capital of $3,575,000 and a surplus of about $1,000,000. The rich agricultural region surrounding the city and the mining region trade contributed to the rapid growth, which has diminished since railroads have been built into the Black Hills and other mining localities. Pop. (1880) 7,366; (1890) 37,806; (1900) 33,111; (1910) 47,828.

Sioux Falls, S. Dak., city, county-seat of Minnehaha County; on the Sioux River, and on the Chicago, M. & St. P., the Chicago, St. P., M. & O., the Illinois Central, the Rock Island, and the Great Northern R.R.'s; about eight miles from the Iowa boundary and 12 miles from the Minnesota boundary. It was settled in 1856 by the Western Iowa Company of Dubuque, Iowa, but was abandoned the next year. Soon afterward the place was again settled by eastern homeseekers. It was organized as a village in 1877, and chartered as a city in 1883. It is in an agricultural and stock-raising region, and in the vicinity are extensive quarries of marble, jasper, and other stones. The river here has a fall of about 100 feet in a half mile, forming a series of cascades which furnish extensive water-power. The chief industrial establishments are breweries, in which are 75 employees; biscuit factory, 100 employees; stone quarries, 100 employees; flour mills, 20; carriage and brick works, foundry, and stove-polish works, have a combined number of 60 employees; marble and mineral waterworks, 20. The wholesale houses employ about 250 men; the agricultural implement warehouses, 300 men; the railroads, 150. Sioux Falls is the commercial and industrial centre of a large portion of the State, and the distributing centre of the products from outside. The principal public buildings are the State penitentiary, State Children's Home, county court-house, municipal buildings and the 30 churches, which include Roman Catholic and

Digitized by Google

Protestant Episcopal cathedral. The seven banks have a combined capital of $450,000. The government is vested in a mayor and 12 aldermen. The aldermen hold office two years, six retiring each year. Pop. (1890) 10,177; (1900) 10,266; (1910) 14,094. J. TOMLINSON, *Editor 'Argus Leader.'*

Si'phon, a pipe through which a liquid may, by the action of gravity, be transferred from one place to another place at a lower level over an obstruction which must be lower than a height which depends on the specific gravity of the liquid. Water may be siphoned over obstacles which are less than 32 feet higher than the surface of the water, and the quantity of water carried depends on the difference of levels at the two sides of the obstacle, and is not influenced by the height of the obstacle farther than to the extent due to the increase of friction in an increased length of pipe.

Siphonoph'ora, an order of free-swimming polyps (*Hydrozoa*). All are remarkable as forming colonies of zooids, which become differentiated as organs of special function, and altogether lose their separate individuality. They present the most noteworthy instances of polymorphic colonies known to zoology, and differ greatly in complexity. In the most complex cases the zooids or polyp organs may be divided into about seven types, each differing in form and function but retaining the fundamental polyp structure. These are: (1) pneumatophores or floats; (2) nectocalyces or swimming bells, whose function is to propel the colony; (3) gastrozooids, or nutritive polyps, which feed the colony; (4) hydrophyllia, leaf-like protective polyps; (5 and 6) dactylozooids and tentaculæ, offensive polyps armed with numerous stinging cells; (7) gonozooids or reproductive polyps of different types. The siphonophores are delicate transparent animals often beautifully colored, and they abound in the Gulf Stream and other warm oceanic waters. A familiar example is the Portuguese man-of-war (*Physalia*). Consult Haeckel, 'Challenger Reports,' Vol. XXVIII. (London 1888).

Siquijor, sē-kē-hôr', Philippines, (1) Pueblo, island of Siguijor, province of Bohol, on the northwest coast of the island. It has a good harbor, and is the chief port and principal town of the island. Pop. 11,790. (2) Island, the second in importance of the province of Bohol, lying southwest of the island of Bohol, and east of Negros; length from east to west, 17 miles; width 12 miles; area, 126 square miles. The surface is much broken, rising to a central peak, 1,394 feet high. The soil is fertile; tobacco of excellent quality, rice, corn, hemp, and chocolate are raised and bartered for wax and cotton; a coarse variety of hemp cloth is manufactured for export; tortoise shell and sea cucumbers (bèche de mer) are gathered in large quantities. The island is densely populated. Pop. 41,746.

Sir, a term of courtesy, applied without distinction of rank, to all persons. It is also the special title in Great Britain of knights and baronets, and as such is always prefixed to the Christian name. *Sire* is a term of respect by which kings are addressed. The word *sir* is the same in origin as *sire,* and is derived from old French *senre,* and that from *senior* (Latin, elder), whence also *seignior, signor,* similar terms of courtesy.

Sir Daria, sēr-dār'yā, Russian Turkestan. See SYR DARIA.

Sirajganj, sē-rāj-günj', or **Serajganj,** India, a town in the district of Pabna, Bengal, on the Jamuna River, 153 miles northeast of Calcutta. The town is six miles from the low water channel of the river, separated by a sandy plain, and the river landing-places shift every flood season. Founded about the beginning of the 19th century, it is now one of the chief river marts in Bengal, having risen with the growth of the jute trade. It collects jute, rice, oilseeds, tobacco, etc., from all the neighboring districts for despatch to Calcutta, and distributes piece-goods, salt, sugar, iron, hardware, etc. The trade is entirely water-borne, 150,000 tons of jute being exported annually. One firm alone employs several hundred hands in weaving gunny, or jute cloth for bags, which is exported to the value of $600,000 a year. Pop. about 25,000.

Si'ren, an instrument for producing continuous or musical sounds, and for measuring the number of sound-waves or vibrations per second, which produce a note of given pitch. In its original form it consists of a disk with a circular row of oblique holes, revolving close

Siren.

to the top-plate of a wind-chest perforated with corresponding holes of a contrary obliquity, so that the jets of air from the latter passing through the former keep the disk in motion, and produce a note corresponding to the rapidity of the coincidences of the holes in the two plates, the number of coincidences or vibrations in a given time being shown by indices which connect by toothed wheels with a screw on the axis of the disk. See also FOG-SIGNALS.

Siren, or **Mud-puppy.** See PROTEUS.

Sire'nia, an order of aquatic herbivorous mammals, with almost hairless skin, no hind limbs, the tail flattened horizontally, and two teats situated on the chest. The unborn young are covered with a thick fur; and many points of dentition, structure, and life history show affinity to the ungulate land mammals. There is much less relationship to the *Cetacea* within which this group was formerly classified. The order embraces but three recent genera, *Manatus, Halicore* and *Rhytina,* the latter now extinct, representing as many families. Besides these a number of fossil genera are known. *Halitherium* occurs in Miocene and Pliocene forma-

Digitized by Google

tions. This form was of large size, and appears to have been somewhat intermediate in structure between the two living genera and to have possessed rudimentary hind limbs. Consult: Brandt, 'Symbolæ Sirenologicæ' (St. Petersburg 1868); Woodward, 'Vertebrate Paleontology' (Cambridge 1898). See DUGONG; MANATEE; SEA-COW.

Si'rens, in Greek mythology, the name of several sea-nymphs, who by their singing fascinated those who sailed by their island, and then destroyed them. When Ulysses approached their island, which was near the coast of Sicily, he stuffed the ears of his companions with wax, while he bound himself to the mast, and so they escaped. The Sirens then threw themselves into the sea, where they became formidable rocks.

Sirius, sĭr'ĭ-ŭs, in astronomy, the brightest star in the heavens, also called the Dog-star, situated in the mouth of the constellation Canis Major, or the Greater Dog. It is estimated to have more than 13 times the sun's magnitude.

Siroc'co, a hot, relaxing, and oppressive southeast wind, which blows in Sicily and South Italy. While it continues the atmosphere is obscured by a haze, and so great is the languor it occasions that few persons quit their houses. It is supposed to be the same as the simoom (q.v.), tempered by its passage across the water.

Sirvente, sĭr-vŏnt, a term used in mediæval literature, to denote a species of poem common among the Troubadours and Trouveres. These songs were usually satirical, though sometimes devoted to love or praises, and divided into strophes of a peculiar construction.

Sisal Hemp, *Agave rigida*, varieties *elongata* and *sisalana*. The growing plant somewhat resembles the century plant, though the leaves are more slender and spear-like; they measure 3½ to 5 feet long, and 4 to 5 inches wide, the general average being 4 to 4½ inches. The product is a structural fibre derived from the older leaves, the first cuttings for fibre being made when the plants are five years old from the date of setting out in the field. The filament is yellowish white in color, straight, smooth, and clean, sisal ranking second to manila in value as a cordage fibre. It is a native of Yucatan, which furnishes the bulk of the world's supply, the Bahamas and very recently Hawaii contributing a little. It is found (introduced) in many parts of Mexico proper, throughout the West Indies, and in Central and South America. Introduced into Florida by Perrine, in 1836, and into the Bahamas by Nesbit, in 1845, Yucatan plants being used, and into Hawaii, from Florida, in 1893. The growth of the plant, experimental or otherwise, has been extended to many parts of the world, commercial cultivation having been attempted in India and on the west coast of Africa.

The commercial supply of the United States is mainly derived from Yucatan. In Florida the plants are found growing semi-wild in small tracts, both on the keys and east and west coasts of the mainland. Small attempts have been made from time to time to establish an industry, but it is doubtful if the culture could be made to pay in Florida, especially in competition with the vast sisal hemp farms of Yucatan. The Yucatan industry is centred at Merida, 20 miles south of Progreso, the port of shipment. On the larger farms systems of miniature railways are laid down for the transportation of the bundles of cut leaves from the fields to the central factories, where the cleaning or scraping process is effected by powerful machines. The operation consists merely of removing the epidermis and soft cellular tissue, which leaves the fibre clean and white; it is then dried in the sun, and baled for market. Sisal hemp and manila hemp make up the bulk of the hard fibre used for cordage in the United States, the larger portion of the sisal going into binder twine for binding the grain crop, though considerable rope is made from it for inland use. While some 56,000 tons of manila was consumed in this country last year, the consumption of sisal hemp amounted to nearly 90,000 tons, worth over $11,963,000, the fibre costing about 10 cents in gold in Yucatan per pound.

See Special Reports (Nos. 1 and 5); Fibre Investigations, Department of Agriculture; 'Scientific American Supplement' (No. 1,837, 2 Aug. 1902); Bulletins Royal Gardens, Kew; Bulletin (No. 4) Hawaiian Agricultural Experiment Station, Honolulu; and James M. Rae, 'Report on the Fibre Industry of the Bahamas' (Nassau 1891). See BAHAMAS; CORDAGE; FIBRE; HEMP; YUCATAN.

CHARLES RICHARDS DODGE.

Sis'cowet. See LAKE TROUT.

Sis'kin, a European finch (*Fringilla spinus*), greenish in general color, with dusky and yellowish markings and the under surface whitish. These birds are usually seen in small flocks, haunting the margins of streams, and are much sought after by bird catchers, and when interbred with the canary produce a hybrid progeny with a sweet mellow song. A very similar Canadian bird is known as the pinesiskin; and the name is sometimes given to the goldfinch.

Sisley, sĭs-lĭ, **Alfred**, French painter: b. Paris 1830; d. 1899. He was little known except as a promising pupil of Gleyre, until the Impressionists held their exhibition in 1874, when his boldness and originality were acknowledged. His indebtedness to Corot and even more so to Monet is apparent in all the landscapes which he produced, characterized as these are by poetic charm and remarkable freshness and frankness in color and detail. Among his works may be mentioned: 'La Seine à Saint Mammés'; and 'L'Inondation, Marly' (1876).

Sismondi, sĭs-mŏn'dĭ (Fr. sēs-môṅ-dē), **Jean Charles Léonard Simonde de**, Swiss historian and political economist: b. Geneva 9 May 1773; d. near there 25 June 1842. He had scarcely completed a careful education at the College and the Auditoire of Geneva when the overthrow of the constitution of his native town obliged him to flee with his father to England. On his return, two years after, he was imprisoned, and lost the greater part of his property by confiscation. Similar persecution followed him even in Tuscany, whither he proceeded in 1795, and where he was hated by the French as an aristocrat, and by the Italians as a Frenchman; but at length, on his return to Geneva in 1800, he was allowed to live in quietness and devote himself with the utmost diligence to literary pursuits without declining to bear his part in the discharge of municipal functions. His first published work appeared

Digitized by Google

in 1801, and was entitled 'Tableau de l'Agriculture Toscane.' It discards all appearance of theory, and abounds in practical details. In 1803 he published a work entitled 'De la Richesse Commerciale, ou Principes d'Economie Politique appliqué à la Législation du Commerce.' This essay was afterward remodeled so as to form the groundwork of his treatise published in 1819 under the title of 'Nouveaux Principes d'Economie Politique.' He had become intimate with Madame de Staël, and in 1805 accompanied her on a tour through Italy. The associations thus awakened appear to have called his attention particularly to history. The first fruits of his labors in this department appeared in 1807, in the first two volumes of his 'Républiques Italiennes,' which ultimately reached 16 volumes, and was not completed till 1818. It was followed by 'De la Literature du Midi de l'Europe' (1813, English translation by Roscoe, 1823). His 'Histoire des Français' (1821-44) occupied the greater part of his remaining life. It was carried to 31 volumes, though reaching no farther than 1750.

Sissoo, or **Sissum.** See DALBERGIA.

Sister-servants of Saint Martha. See ORDERS, RELIGIOUS.

Sisterhood of the Good Shepherd; Sisterhood of the Holy Child; Sisterhood of the Holy Family; Sisterhood of the Holy Nativity. See ORDERS, RELIGIOUS.

Sisters, Apostoline; Sisters of the Assumption; Sisters of Atonement; Sisters of Bethany; Sisters of Bon Secours; Sisters of Charity; Sisters of the Divine Compassion; Sisters of the Faithful Virgin; Sisters of the Holy Child Jesus; Sisters of the Holy Cross; Sisters of the Holy Ghost; Sisters of Sagasse; Sisters of Mercy; Sisters of Misericorde; Sisters of Our Lady of Good Counsel; Sisters of Our Lady of Perpetual Help; Sisters of the Poor; Sisters of Providence; Sisters of Saint Agnes; Sisters of Saint Ann; Sisters of Saint Augustine; Sisters of Saint Benedict; Sisters of Saint Bridget; Sisters of Saint Dominic; Sisters of Saint Francis; Sisters of Saint John the Baptist; Sisters of Saint John the Evangelist; Sisters of Saint Joseph; Sisters of Saint Margaret; Sisters of Saint Mary; Sisters of Saint Monica; Sisters of the Sorrowful Mother; Sisters of the Transfiguration. See ORDERS, RELIGIOUS.

Sistine Chapel. See VATICAN, THE.

Sistine Madonna. See MADONNA.

Sistrum, a kind of rattle or jingling instrument used by the ancient Egyptians in their religious ceremonies, especially in the worship of Isis. It consisted of a thin somewhat lyre-shaped metal frame through which passed loosely a number of metal rods, to which rings were sometimes attached.

Sistrum.

Sisyphus, sĭs'ĭ-fŭs, a well-known character in mythology, often quoted as an example of fruitless and recurrent toil. He is related to have been a king of Corinth, and to have given offense to both Jupiter and Pluto. As a consequence he was condemned after death to roll a heavy stone to the top of a hill, on reaching which it would always roll back again; thus making his punishment eternal.

Sita, sē'tä, in the system of Hindu divinities, the wife of Râma, or Vishnu incarnate, carried off by the giant Ravana. She was not born, but arose from a furrow when her father, Janaka, king of Mithila, was plowing. The word means "furrow."

Sitatunga. See BUSHBACK.

Sit'ka, a tribe of the Koluschan stock of North American Indians, formerly residing on Norton Sound, Alaska, but were driven therefrom by the Russians to Baranof Island, where their principal village, Sitka, was established. In 1880–1 they numbered 720, of whom 540 resided at Sitka; in 1890 their population was 815. In addition to Sitka they had temporary villages at Hot Springs and Indian River.

Sitka (formerly NEW ARCHANGEL), Alaska, city port of entry, capital of the Territory; on the west coast of Baranof Island; about 1,300 miles north of San Francisco. It was founded in 1799–1800 by Alexander Baranov, the then Russian manager of Russian America. For a time Sitka grew in importance as a trading station, and even as a manufacturing town. It was for a time the commercial port not only of Russian America, but of the Pacific coast of America. The managers of the industries which made Sitka of importance failed in some of their new enterprises, and gradually the place dwindled to an Indian village of about 100 log huts. Such the United States forces found it when they took possession 18 Oct. 1867. It is a coaling station for the United States navy and has a number of industries which not only supply the local needs, but which are a means of trade with the neighboring islands. In 1903 there were Russian Orthodox, Presbyterian, Roman Catholic, and Protestant Episcopal churches. There were two public graded schools, and the Sitka Training School (Presbyterian), an industrial school. In the training and industrial schools, special attention is given to farming and domestic science. Pupils from Sitka attend the Indian School at Carlisle, Pa. Among the places of interest are Saint Michael's Church, built in 1816 by the Russian Orthodox, the hospital, and a museum. The island has a great variety of trees, mosses, and flowers; over 300 different kinds of wild flowers have been found here. Pop. about 1,500. See ALASKA, RECENT DEVELOPMENT OF.

Sitting Bull, Sioux Indian chief: b. Dakota about 1837; d. 15 Dec. 1890. He was the son of Jumping Bull and the nephew of Four Horns and Hunting-His-Lodge, all Sioux chiefs. He was first named The Sacred Stand; but at 14, having slain and scalped his first enemy, his name was changed to Sitting Bull (in Indian, *Tatanka Yotanka*). As a young man, he showed enmity toward the whites and was repudiated by the more peaceable members of the tribe. During the Civil War he led in massacres of whites in Iowa and Minnesota, and in 1864 was driven by United States troops into the Big Horn country and to the Yellowstone. In 1866 he made a pretense of treating with the govern-

Digitized by Google

ment, but the next year was again on the war path, and until 1876 was almost continually engaged in warfare with whites or friendly Indians. That year his band exterminated the force commanded by Gen. Custer sent against them on the Little Big Horn. After the massacre he escaped with his followers into Canada, and there remained until 1879, when to end a precarious existence he accepted the amnesty promised by Gen. Miles and returned to United States territory. Though submissive he was never friendly toward the government, and in 1888 influenced the Indians not to sell their lands. During the Messiah craze of 1890 his influence was considered dangerous, and his arrest was ordered. In the attempt to carry out this order he was killed together with his son, several chiefs, and members of the Indian police.

Siut, sē-oot', or **Assiut**, ā-sē-oot' (ancient, LYCOPOLIS), Upper Egypt, (1) The capital of a province of the same name, situated in a fertile district near the left bank of the Nile, 247 miles by rail northwest of Cairo. The town is about three quarters of a mile west of the river, where a modern barrage and lock in connection with the great Nile irrigation scheme (see ASSOUAN) was completed in 1902. The main street, running east and west, is about three miles in length. Among the chief buildings are the railway station, the government buildings, a good hospital, public baths, an American Presbyterian mission station, with schools; mosques, bazaars, etc. Near the town are some ancient rock tombs. Siut has a trade in excellent pottery, linen, leather goods, carved ivory, natron, soda, and corn. Plotinus, the great Neo-Platonic philosopher, was born here in 205 A.D. Pop. about 45,000. (2) The province has an area of 840 square miles; pop. about 800,000, giving about 950 to the square mile; 30,048 of the population were nomads and 439 foreigners.

Siva, sē'va, the third deity in the great triad of Hindu gods. His name signifies in Sanskrit «happy,» «of good omen,» and he typifies both destruction and reproduction. His worshippers are called Saivas, and they assign to him the first place in the Trimûrti or triad, attributing to him also many attributes which properly belong to the other deities. According to the Saivas Siva is Time, Justice, Water, the Sun, the Destroyer, and the Creator. He is represented in his characters of the god of regeneration and of justice as riding on a white bull. He has five heads; three eyes — one on his forehead, indicative of his power of contemplation; two, four, eight, or ten hands; and in the middle of his forehead a crescent. His throat is dark blue; his hair of a light reddish color, thickly matted together, and brought over his head so as to project like a horn from his forehead. He wears a garland of human skulls around his neck, and as a second necklace a serpent; and in his hand holds a trident, surmounted by a skull, and one or two human heads. He is often represented as entirely covered with serpents, which are the emblems of immortality. His weapons are the *Khinkhira*, of which nothing is known, a bow called *Ajakava*, a thunderbolt, and an axe. He resides on the wonderful Mount Kailâsa, the northern peak of the Himalaya. One of his principal attendants is Tandu, a teacher of the arts of dancing and mimicry, whence Siva is the patron of dancers. Siva has more than 1,000 names, which are detailed at length in the 69th chapter of the Siva-Purana. These names are mostly all derived from his attributes and character. Among the exploits of Siva is recorded his having cut off, in a fit of anger, one of the five heads of Brahma. He likewise beheaded his father-in-law, Daksha, for having offended his wife; but on the interference of the gods he placed a ram's head on the headless trunk.

Siva-snake, the king cobra. See HAMADRYAD.

Sivas, sē-väs', or **Rhum**, Asia Minor, (1) Capital of the vilayet of that name on the Kizil Irmak, 170 miles southwest of Trebizond. It contains some fine ruins of Seljuk art, chief of which are the *medresses*, or colleges of the 13th century. One of them contains the tomb of Izz-ed-din Kai Kaús I., the founder (1210–19). In the Armenian convent are preserved several relics, among them the throne of Senekherim. The heights are crowned by castles, and the general view, including mosques, minarets, colonnades, etc., baths, khans, and bazaars, through which wind the narrow streets, is typically Oriental. There are Armenian churches, American, and Jesuit schools and missions, and manufactories. On the route from Bagdad to Diarbeker and Malatiyeh and thence to the Black Sea, it is important commercially. The chief manufactures are coarse cotton cloth and woolen hose. The inhabitants are Moslems, Armenians, and Greeks. Under Diocletian it became an Armenian capital, and was an emporium of wealth under Turkish dominion. 1172 it was captured by the Seljuk sultan of Rum. In 1400 when the city was taken by Timur it was a considerable metropolis; but never recovered from the atrocities perpetrated at that time. In 1895 a cruel massacre of Armenian Christians again decimated its population. Pop. 45,000. (2) Sivas is a large vilayet, and one of the most important of the country. Its area is 32,300 square miles. It has a productive soil; the main crops are wheat and barley; fruit orchards and vineyards are extensively cultivated. The chief mineral deposits are: silver, lead, salt, coal, iron, alum, arsenic, and manganese. The exports include grain, flour, textiles, tobacco, opium, wool, carpets and cattle. The principal imports are cotton manufactures. An excellent climate. Pop. 1,090,000.

Sivash, sē-väsh', or **Putrid Sea**, Russia, a salt lagoon on the northeast coast of the Crimea. It is separated from the Sea of Azov by a narrow sand bar, and has an area of over 900 square miles. It is very shallow, and its water is stagnant and very salt.

Sivathe'rium, a great ungulate mammal, almost as big as an elephant, whose remains occur in good condition in the Pliocene (Siwalik) deposits of India. After much discussion its place has been decided to be with the giraffes, although it has many similarities to such aberrant «antelopes» as the pronghorn and the saiga. The male had two pairs of horns, supported on bony cores, as in living antelopes, sheep, etc. The front pair of horns (on the frontal bones) were of simple form, while the larger hinder pair (on the parietals) were large, palmated, and much like those of a modern moose, but less

Digitized by Google

expansive. Murie has suggested that the sivatherium, like the existing prongbuck, may have shed the sheaths of its horns annually; and this theory may account for the fact that the horn-sheaths have never yet been found in a fossil condition. *Vishnutherium* and *Hydraspotherium* are closely allied genera.

Siwah, sē'wä, or **Ammon,** Egypt, a small oasis 320 miles southwest of Cairo. It lies below sea-level and consists of a valley dotted by several lakes, prairies, palm groves, gardens, and fields; abundantly watered and enclosed by steep hills. It is very fertile, has an abundance of dates, melons, olives, pomegranates, grapes, beans, barley, wheat, and rice, besides salt. Basket-weaving and agriculture are the chief industries. Artesian wells abound. Agermih is the chief town, built upon steep rocks, and contains some ruins of temples, and deep wells. An Egyptian gate and a large room covered with hieroglyphics are supposed to belong to an ancient royal palace. In the vicinity is the Fountain of the Sun, a salty spring. Pop. 3,750.

Six Companies. See Chinese Immigration.

Six Nations, The, classed as Iroquois Indians, occupied from time immemorial the Canada border along the Saint Lawrence River, as well as a long stretch of territory in New York extending from the Hudson River to Lake Erie. A Sixth Nation was connected with the Canadian group, but the American Iroquois were known as The Five Nations. The present title followed the adoption by the Five Nations, known as the Iroquois Confederacy, or League, of the Tuscaroras, a kindred people who had drifted into North Carolina, and having failed to secure peaceable relations with the increasing white emigration, sold out their lands and removed, between the years 1715 and 1722, to the vicinity of Oneida in the colony of New York. They were promptly adopted by the Iroquois Confederacy as a Sixth Nation. The Senecas gave them one mile square of land in Niagara County, and by two purchases from the Holland Land Company, out of the proceeds of sales in North Carolina, they secured an aggregate holding of 6,249 acres, which they still retain near Lewiston, N. Y.

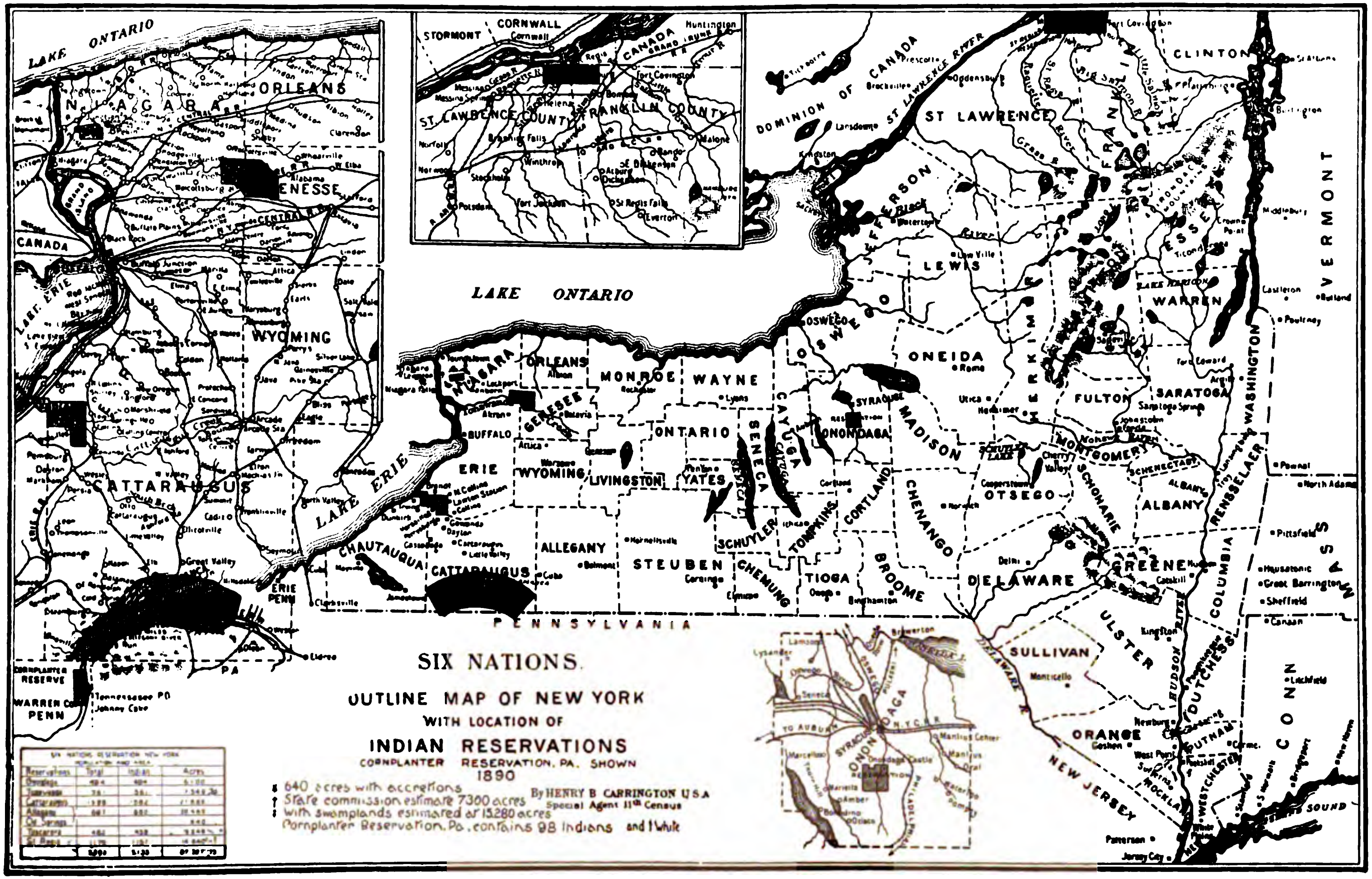
The advent of the white man upon the Atlantic coast was at a time when this Iroquois League had practically mastered the Algonquin tribes, which in Canada, New England, the middle colonies and the West, had encircled the New York Indians as by a girdle of fire. The Algonquins embraced many tribes which had no common bond of union, but the Iroquois League, although of aristocratic temper, was quite republican and representative in form. Each Nation managed its private affairs independently, through chiefs and councils, but sent delegates to a Federal, or National Congress or Council, which controlled all interests that were common to the represented peoples. Women also were recognized as having a decisive voice in the election of delegates, and were esteemed as the rightful umpires in all questions of war or peace. The limit to which men were to be subject to battle risks was for them to determine.

Jefferson, in framing a Constitution for the United States, honored these peoples by the adoption of their general constitutional system. The Five Nations proper, called «cabin-builders» because of singular skill in framing homes, gave to the stretch of land occupied by them in New York, the name «long house,» the eastern door of which was guarded by the fierce and warlike Mohawks, where the river of the same name empties into the Hudson, while the western door was guarded by the Senecas, the most numerous and skilful of all, on Lake Erie. The Oneidas, by Oneida Lake, the Onondagas, by Onondaga or Salt Lake, and the Cayugas, by Cayuga Lake, completed the chain of confederated Indian territory. The Federal capital, where National Councils were held, was located among the Onondagas, a few miles south from the later city of Syracuse, and here the National Council fires were lighted when the interests of the Nations required common action by and in behalf of all, when summoned to a general conference. Here Hiawathe, reverently known as «the wise man,» announced his scheme for common action, as they assembled for his counsels. His appeal reads like that of Jacob to the Hebrew Tribes in very ancient history, when individual characteristics were specifically honored, and is worthy of record as a true description of peoples who afterward developed such marvelous endurance, courage and advancement. It reads as follows:

«We have met, members of many Nations, many of you from a great distance from your homes, to provide for our common safety. To oppose those foes from the north by tribes, and singly, would prove our destruction. We must unite as a common band of brothers and we shall be safe. You, Mohawks, sitting under the shadow of great trees whose roots strike deep into the earth, whose branches spread over a vast country, shall be the 1st Nation, because you are warlike and mighty! You, Oneidas, a people who recline your bodies against the ever-lasting stone that cannot be moved, shall be the 2d Nation, because you give good counsel! You, Onondagas, who have your habitations at the great mountain and are overshadowed by its crags, shall be the 3d Nation, because you are greatly gifted in speech and are mighty in war! And you, Cayugas, whose habitation is in the dark forest and whose home is everywhere, shall be the 4th Nation, because of your superior cunning in hunting! and you, Senecas, a people who live in the open country and possess much wisdom, shall be the 5th Nation, because you understand the art of raising corn and beans, and making cabins! You, Five Nations, great and powerful, must unite and have but one interest in common, and no foe shall be able to subdue us. If we unite, the Great Spirit will smile upon us! Brethren, these are the words of Hiawathe! Let them sink deep in your breasts!»

Each description was typical of forest, quarry, hill, or open country occupied by these Nations, and of the characteristics which later history verified. Coupled with this community of interest was a subordinate system of societies, tribes, or clans, bearing such names as Wolf, Turtle, Bear, Snipe, Beaver and others, whose members affiliated with brethren of similar clans in the other nations, so that, to cite Morgan, «the whole race was woven into one great family of households; and during the whole history of the League, they never fell into anarchy nor verged upon dissolution from internal disorder.»

Digitized by Google


SIX NATIONS.
OUTLINE MAP OF NEW YORK
WITH LOCATION OF
INDIAN RESERVATIONS
CORNPLANTER RESERVATION, PA. SHOWN
1890
By HENRY B CARRINGTON U.S.A.
Special Agent 11th Census
640 acres with accretions
State commission estimate 7300 acres
with swamplands estimated at 13280 acres
Cornplanter Reservation, Pa. contains 98 Indians and 1 White
LAKE ONTARIO
LAKE ERIE
DOMINION OF CANADA
ST LAWRENCE RIVER
PENNSYLVANIA
VERMONT
CONN
NEW JERSEY
ST LAWRENCE
FRANKLIN
CLINTON
ESSEX
JEFFERSON
LEWIS
HERKIMER
HAMILTON
WARREN
WASHINGTON
OSWEGO
ONEIDA
FULTON
SARATOGA
MONTGOMERY
SCHENECTADY
RENSSELAER
ALBANY
NIAGARA
ORLEANS
MONROE
WAYNE
CAYUGA
ONONDAGA
MADISON
OTSEGO
SCHOHARIE
GREENE
COLUMBIA
ERIE
GENESEE
WYOMING
LIVINGSTON
ONTARIO
YATES
SENECA
CORTLAND
CHENANGO
DELAWARE
ULSTER
DUTCHESS
CHAUTAUQUA
CATTARAUGUS
ALLEGANY
STEUBEN
SCHUYLER
TOMPKINS
CHEMUNG
TIOGA
BROOME
SULLIVAN
ORANGE
PUTNAM
WESTCHESTER
ROCKLAND
CANADA
CORNPLANTER RESERVE
WARREN CO. PENN
STORMONT
CORNWALL
ST. LAWRENCE COUNTY
FRANKLIN COUNTY

Digitized by Google

The advent of Champlain's French followers, with firearms, gave fresh stimulus to Iroquois enterprise. Securing and mastering the use of as many guns as possible, they fearlessly extended their range of triumphs. In 1643 they destroyed the Eries and pushed for the Ohio. In 1670, they controlled the whole country between Lakes Huron, Erie and Ontario, and the north bank of the Saint Lawrence as far as the Ottawa River, near Montreal. They terrorized New England, and in 1680 invaded Illinois, even to the Mississippi River, at the time when La Salle was preparing to descend its current to the sea. The Cherokees upon the Tennessee, and the Catawbas of South Carolina, yielded captives to their demand, and both Lake Superior and Michigan were visited by their warriors and huntsmen. Even as early as 1607, Captain John Smith met a band of the Iroquois in their canoes upon the upper waters of the Chesapeake on their way to the territories of the Powhatan Confederacy. For an entire century they were the controlling interior power, and only their protracted wars with the French exhausted their resources and limited their range of empire. As early as 1535, Cartier made a vocabulary of Indian words, showing that the Iroquois language was spoken by the Hurons who had been practically conquered and absorbed by the Iroquois. Parkman writes, «Among all barbarous nations of this continent these stand the most prominent.» Martin, in his 'Crania Americana' writes, «The brain capacity of the skull of this people is only two inches less than that of the Caucasian. They are unsurpassed by any primitive people.» Morgan writes, «To this people France must chiefly ascribe the final overthrow of her magnificent colonization in the northern part of America.» Jeffries, in his book upon the human races, writes, that «The Five Nations, at the landing of the Pilgrims, constituted a rising power in America; and had not New England been settled by Europeans, it is most likely that the Iroquois would have extirpated the inferior tribes.» Certain it is that such men as Joseph and John Brant, and other Mohawks, and others, Senecas, like Cornplanter, the friend of Washington, Governor Blacksnake, and Red Jacket, were of rare wisdom, courage, and skill.

Both French and British governments, as well as Washington, at a later date, respected their land tenures and treated with them as independent Nations; and under those treaties, still in force, they retain their immense land holdings, legislate for themselves, and maintain their own courts.

During the Revolutionary War, the Oneidas in vain protested against the alliance of either Nation with the British. Eventually, together with the Oneidas, they sold their lands and moved to Wisconsin, where, in 1890, they still numbered 1,710. On 29 Aug. 1779, for wanton depredations by them committed, General Sullivan, in the battle of Chemung, near Elmira, N. Y., destroyed their villages, orchards, gardens, and supplies, including more than 1,000,000 bushels of corn. The Mohawks, however, at the close of the Revolutionary War, fearing punishment, escaped to Canada. The Saint Regis, of kindred stock, living largely on the south bank of the Saint Lawrence River, took their place as one of the Six Nations, and are still represented in amicable conference with the others. The accompanying map locates the land holdings of each surviving people, as well as the small handful belonging to the Cornplanter Reservation just across the Pennsylvania boundary to the southward. Its accompanying table also gives the population and acreage representing each band, the land embracing 87,327 acres, to which they hold absolute title.

Under the 11th United States census (1890) each of the 1,009 families was visited, and minute details were secured as to their property, both real and personal, as well as statistics of buildings, churches, schools, manufactures, farming and social activities, and all possible data respecting their traditions, religious distinctions, and general progress in civilized usages and law. The origin of these peoples, so manifestly superior to other North American Indians, cannot be definitely established through any authentic records. Many Hebrew antecedents characterize their laws of family descent, and among the Tonawanda Senecas, upon the Reservation, so named, biblical Hebrew names largely predominate. On the Tuscarora Reservation there was excavated from a mound upon which trees indicated an origin prior to the advent of the Jesuits, a statuette-group, representing a man with uplifted face, embracing a child, while at his side a lamb was resting. Some of their old men claimed that this group was a memorial of the interrupted sacrifice of Isaac by Abraham, his father. A common recognition of the Great Spirit as an almighty and beneficent Father obtains among all these peoples, as an immemorial tradition, and nearly one half upon several reservations retain their ancient rites of worship, and quite largely their dress, along with observance of dances and feasts, derived from their ancestors.

They opposed enslavement of captured prisoners, made regard for old age, for children, for orphans, and for strangers, matters of primal obligation, and worshipped no false gods. The forces of nature were not deified, but all were recognized as expressions of the power, wisdom, and manifestation of the Great Spirit in his care for his children on the earth. Their regard for heroic and beneficent character was so marked that after Handsome Lake, brother of Tecumseh, introduced what was styled «the new religion» in 1807, they honored Washington by locating him at the gate of Paradise, where, on the arrival of the Iroquois, he both saluted and recognized the salute of those entering within the portal. Nominally, in religious matters, they are known as Pagan, and Christian. These terms simply indicate the distinction between those who adhere to the dress, language, beads, dances, feasts, and ceremonies of their old religion, and those who adopt the Caucasian language, dress and social habitudes exclusively. The Tuscaroras are Protestant Christians, however, for the greater part; and the Saint Regis are Roman Catholics, as are their brethren of the same name across the Saint Lawrence, in Canada. The Tonawandas, and the Onondagas, are largely Pagan.

The Senecas, especially, have their national president and council, and the official council house is upon the Cataraugus Reservation, which excels in comfortable homes, fine barns, choice stock, and the acquirements of advanced modern

Digitized by Google

civilization. The Tuscaroras excel in the raising of grains and fruit. Good churches and schools are sufficient for their needs, and in musical and other social and æsthetic lines their natural tastes find enjoyable exercise. The Cataraugus Agricultural Fair is noted for its exhibits of choice stock, fruit, implements, and domestic manufactures, and for many years temperance societies have held an annual convention in the interest of that reform.

The problem of their future condition, so long as their great land holdings excite the envy and thirst of outsiders, is yet to be solved by such ultimate adjustment of their relations to neighboring white settlements as they may voluntarily accept, by agreement with the Federal and New York authorities. They are, practically, tenants in common, on each reservation cluster, and each family may have such land as it can utilize, and also devise the same by will, except to whites or aliens. Children take the mother's rights, and marriage with the whites is rare and opposed. Their own Peacemaker's Courts have probate jurisdiction, and except in the matter of crimes, and postal service, they constitute a *regnum in regno* within the United States. Even the 40-mile strip, one mile wide, along the Allegheny River, including the city of Salamanca, pays a ground-rent for land used for building purposes.

In the year 1890, the aggregate population of the Iroquois, including Canada, was 15,870, a larger aggregate than, as taken at 14 previous estimates, since 1660, and the New York Indians had increased to the number of 5,133. The aggregate in the United States and Canada in 1877 was estimated at only 13,666.

Consult: Special Census Bulletin of the Six Nations (1892); Indian Vol. 11th Census Schoolcraft, 'Indian Tribes'; Martin, 'Crania Americana'; Drake, 'History and Biography of the American Indians'; Morgan, 'Indians of New York'; Jeffries, 'History of the Human Races'; Johnson, 'Six Nations and Tuscaroras, et al.' HENRY B. CARRINGTON, U. S. A.

Six-principle Baptists, an American sect of Baptists, claiming origin in Rhode Island. The six principles from which they derive their name are, repentance for dead works, faith toward God, the doctrine of baptism, laying on of hands, resurrection of the dead, and eternal judgment (Heb. vi. 1–3). See BAPTISTS.

Sixtus, sĭks'tŭs, the name of five popes, as follows:

Sixtus I., Saint. He succeeded Alexander I. in 119, and suffered martyrdom in 127.

Sixtus II., Saint: d. 258. He succeeded Stephen I. in 257, and according to some accounts was an Athenian philosopher before professing Christianity. He was martyred during the persecution of the Christians by Valerianus.

Sixtus III., Saint: d. 440. He succeeded Celestine I. in 432. He was active in attempting to reconcile the disputes existing in the Eastern Church, particularly in the case of Cyril, bishop of Alexandria, and John of Antioch. Several letters by him with regard to those controversies are extant. He was a munificent patron of learning, and is stated to have left a large sum to be expended in the adornment of ecclesiastical structures.

Sixtus IV. (FRANCESCO DELLA ROVERE, frän-chĕs'kō dĕl'lä rō-vä'rā): b. Savona 22 July 1414; d. 13 Aug. 1484. He was the son of a Genoese fisherman, and entered the Franciscan order, where his learning and eloquence soon attracted attention. His abilities secured him the chair of divinity at Padua and other Italian universities, and he also became general of his order. He was made cardinal by Paul II., whom he succeeded in 1471 through the influence, it was supposed, of Cardinal Bessarion, whose close friend he was. He was an enlightened patron of art and during his occupancy of the papal chair the Sistine Bridge was erected and the famous Sistine Chapel. Many of his relatives were advanced to high places of profit by him, and for this he was much criticised. He reformed the papal coinage and did much to improve and beautify Rome.

Sixtus V. (FELIX PERETTI, fā'lēks pā rĕt'tē): b. near Montalto 18 Dec. 1521; d. Rome 27 Aug. 1590. His boyhood was spent as a swineherd; but, giving early indications of an aspiring disposition, he was admitted to the Franciscan order in 1534, and received the usual strict education and instruction of the monasteries. In 1544 he gave instruction in the canon law at Rimini, and in 1546 at Siena. In 1548 he was made priest, doctor of divinity, and superintendent of the monastic school of Siena. In 1556 he removed to Venice, where he was appointed superintendent of the Franciscan school, and afterward inquisitor-general. In 1560 he quitted Venice and proceeded to Rome, where the pope conferred upon him several dignities. Some years later (1565) he attended the papal legate to Spain as the theologian of the embassy, and while here acquainted himself with the policy of the Spanish court. In 1570 he was made cardinal by Pius V. He was elected to the Papal See in 1585, and during his five years' administration devoted himself with great vigor to the reform of abuses both civil and ecclesiastical. Under his immediate predecessors, Pius V. and Gregory XIII., the civil disorder was excessive in the states of the Church, crimes had gone unpunished, and hordes of brigands infested the whole country. All this was now remedied, stern justice was administered on all hands, the country cleared of robbers, and under the security thus produced, agriculture, commerce, and industry flourished anew. Sixtus founded a new university at Fermo, and new colleges at Rome and Bologna; and embellished Rome with numerous and useful structures, among others the present building of the Vatican Library. He published a new edition of the 'Septuagint' in 1587, and one of the 'Vulgate,' with improvements, in 1590, besides corrected editions of the Church Fathers. He displayed the same energy in the spiritual administration of the Church, re-established discipline in the religious orders, and founded or reformed several congregations of cardinals and other officers. He fixed the number of cardinals at 70. He took a part in most of the great events that then agitated Europe. He encouraged and supported Henry III. against the Huguenots, Philip II. against England, and Archduke Maximilian when he was a candidate for the Polish crown. The great aim of his foreign policy was the promotion of the cause of

Digitized by Google

Roman Catholicism throughout all Christendom against Protestantism.

Si'zar, a term used in the University of Cambridge, and at Trinity College, Dublin, to denote a class of students of limited means who usually receive their commons free and are pecuniarily assisted otherwise. They were originally required to perform certain duties of a menial character, but this practice has long ago fallen into desuetude. Formerly there was a similar class of students at Oxford called servitors.

Size, a glue or adhesive varnish used in many industrial pursuits. House-painters' size is prepared from shreds of leather boiled and strained; papermakers use two kinds, one made from hide cuttings, alum, and soap, and a second of rosin and potash; and the size employed in gilding, japanning, etc., is variously composed of linseed oil, copal, red leather, litharge, vermilion, etc., with turpentine.

Skagen, skā'gĕn, **Cape**, or **The Skaw**, skâ, Denmark, the extreme northern point of Jutland. It is a low sand bar or narrow tongue of land carrying near its extremity an important lighthouse.

Skager Rack, skăg-ĕr-răk', or **Skagerrak**, the broad channel connecting the North Sea with the Kattegat, and separating Norway from Jutland. It is about 125 miles long and 70 to 90 miles wide. Its southern part is shallow and beset with sand-banks, but it is very deep along the Norwegian coast. Its navigation is dangerous on account of frequent and violent storms.

Skagway, skăg'wā, or **Skaguay**, Alaska, city, on Chilkat Inlet, at the head of Lynn Canal. It is at the entrance to White Pass and near Chilkoot Pass; about 180 miles north of Sitka. It is on the White Pass & Yukon Railroad, which with other railroads and with water routes makes a continuous rail and water route from Skagway to Seward Peninsula. (See Alaska, Recent Development of.) There were trading stations in the vicinity, and it may be on the site of the present city, but they were established and abandoned to suit the needs of the traders. The settlement of the present city began in 1897 when a miner from Minneapolis, Minn., opened a wagon road across White Pass from the Canadian gold fields. From a town of tent-cloth dwellings it has become a fairly well-built city, with manufactories and stores to meet the demands of a large number of the mining camps of the interior. In 1899 a college was established with Doctor La Motte Gordon, an Oxford graduate, as president and with 50 pupils in attendance.

In 1903 there were four public schools, and Presbyterian, Roman Catholic, Protestant Episcopal, and Methodist churches. Pop. (1910) 3,200.

Skald, **skâld or skôld** (in Old Norse Skâld, poet), a title applied to certain men skilled in composing panegyrics, a form of the poetic art which was distinct from the Edda, the latter being much more artless and simple as it was in fact intended for the ear of the people. The earliest of these Skalds was the mythical Starkadh the Old. The following are the names of the most famous of his successors: Thjodolf, author of 'Ynglinga-tal'; and Thorbjorn the minstrel and author of 'Haralds-mal,' both of whom flourished at the end of the 9th century at the court of Harold of the Bright Hair. In the 10th century lived the Norwegian skald Eyvind who sang the exploits of the famous 'Hakonar-mal'; and the Icelander Egil, who gave his name to the Egils-Saga. More obscure are Hallfredh, Gunlaug, Glum, Eyjolf, etc. The last of the skalds was Skurla who died 1284.

Consult: Grondal, 'Clavis Poetica' (1864); Baldisarson, 'Islendingadrapa' (edited by Möbius 1874); Wisen, 'Carmina Norroena' (1889); Anderson, 'Norse Mythology' (1875).

Skarpanto, skăr'pān-tō, or **Scarpanto**. See Carpathos.

Skat, an intricate game of cards originating in Germany about the year 1800. Thirty-two cards are used and three or four persons take part in the game, although but three are active players. Each player holds ten cards, two being laid aside for the "skat." The use of these two cards determines the game. For a complete description of the game consult Hoffman, 'Book of Skat'; Eichhorn, 'American Skat.'

Skate. See Ray.

Skates and Skating. A skate consists of a frame shaped somewhat like the sole of a shoe, underneath which is fastened a metallic runner, the whole being intended to be fastened, one under each foot, for gliding rapidly over the ice. Skating seems to be of great antiquity, mention being made of it in the Edda. Both in Edinburgh and in London skating was a highly popular amusement several centuries ago. In Holland, from time immemorial, skates have been used by all classes of people upon the canals and rivers for the facility of locomotion they afford. Great variety in the manufacture of skates has been introduced within a comparatively short period. In the most improved forms the wood of the older skate has been replaced by metallic fittings, and the skate is attached to the foot by spring fastenings, which obviate the need for straps. Figure skating is now much practised in the United States, Canada, Holland, Germany, Norway, Sweden, and Denmark; but the nature of the skating in vogue is calculated to excite astonishment at the acrobatic dexterity displayed rather than pleasure at the grace and elegance of the gliding movement which should distinguish good figure skating.

Skeat, skēt, **Walter William**, English scholar: b. London 21 Nov. 1835. He was graduated from Christ College, Cambridge, in 1858, and two years later became a fellow of his college and curate of East Dereham, in Norfolk. In 1862 he went to Godalming, in Surrey, as curate. He was appointed a mathematical lecturer of Christ's College in 1864, and since 1878 has held the Erlington and Bosworth professorship of Anglo-Saxon in the university. Skeat's work in the philology of the English language, especially in its older forms, is of the utmost value, and has contributed much to stimulate interest in such studies. His chief original publications in this department are: 'A Mœso-Gothic Glossary' (1868); 'Etymological Dictionary of the English Language' (1879–84), his most important work; 'Concise Etymological Dictionary of the English Language' (1882; new ed., re-

Digitized by Google

written and rearranged, 1901); 'Principles of English Etymology' (two series, 1887 and 1891); 'Primer of English Etymology' (1892), a smaller work based upon the preceding, but dealing only with the native element; 'The Chaucer Canon, with a Discussion of the Works associated with the name of Geoffrey Chaucer' (1900); 'Place Names of Cambridgeshire' (1901); and 'Notes on English Etymology' (1901). Among numerous editions of English texts which he has edited for various societies and publishers may be cited 'Lancelot of the Laik' (1865); 'Havelok the Dane' (1868); 'The Vision of William concerning Piers the Plowman' (1886), giving the three texts parallel, with notes, glossary, etc.; 'Ælfric's Lives of Saints' (1882–98); Chatterton's 'Poems' (1871); 'The Works of Chaucer' (with notes, glossary, etc., 1894–5); with a supplementary volume of spurious Chaucerian pieces, 1897); and 'The Student's Chaucer' (1895). He founded the English Dialect Society in 1873, and was its chief member during the 23 years of its existence. For it he prepared several provincial glossaries, and upon these and other publications of the society the new 'Dialect Dictionary' is based. 'A Student's Pastime' (1896) consists of articles contributed by him to 'Notes and Queries.' He has also translated Uhland's 'Songs and Ballads' (1864).

Skee, or Ski, a wooden snow-shoe, or runner of wood, from five to ten feet long, an inch or more thick at the middle, but thinner toward the ends, and curved up in a curve at the front. The skee is popularly worn in Norway and other northern countries. The fastening of the skee to the feet is very simple, consisting of a loop of leather for the toe and a band which passes from this around the heel of the shoe, thus making the skee and the foot as firm as possible, which is necessary in order to steer well, while full freedom is allowed the heel to rise from the skee at every movement. When first putting on the skee a balancing stick is necessary, and, indeed, it will be found indispensable for some time; the most skilful runners need but a small stick. An ordinary skee runner is expected to maintain a gait of 8 or 9 miles an hour for quite a length of time. The longest race on skees, the distance being nearly 140 miles, was run in less than 22 hours, rests included. A race in Christiania won by a peasant in less than 5 hours covered 32 miles, laid out over hilly ground including all kinds of difficulties calculated to test the competitors' skill. The annual tournaments held in the principal cities of Sweden and Norway are the great sporting events of the year and when the noted jumpers are to run, the king is sure to attend, the great feature of the sport being the ability to take long flying leaps. There have been a number of skee tournaments in Minnesota, and the number of runners in the United States has increased to an extent that has warranted the organization of a National Association. The skee is in popular use in the Rocky Mountains and in Canada.

Skeed. See SKID.

Skel'eton, the more or less hard structures, mainly of bony nature, which form the internal axis of support of the soft parts in the higher or vertebrate animals. The term, however, is used in comparative anatomy to designate supporting parts not only of internal, but also of external nature. Anatomists thus speak of an endoskeleton as proper to the vertebrates, but both vertebrates and invertebrates may have certain hard parts developed on the exterior of their bodies (for example, shell of lobster, scales of fishes, etc.), and to the latter class of structures is applied the name exoskeleton. The parts of any endoskeleton may generally be grouped under the two heads of the spinal or axial skeleton, and the appendicular parts. The former includes the skeleton of the head and trunk, the latter that of the limbs. The spinal skeleton involves the consideration of the skull (q.v.), spinal or vertebral column, composed of its various vertebræ, and of the thorax (q.v.) or chest, and pelvis (q.v.). The composition of the skull forms a subject of great intricacy, and involves many highly technical considerations. The more general characters of the skull are noted in a separate article (see SKULL). The vertebræ or component parts of the spine or backbone consist each of a solid piece or body, attached to which are various processes. The spinal arches spring from the posterior part of each vertebra, and unite to form the spinous process; the spinal cord itself being protected within the canal formed by the apposition of the arches of the vertebræ. In man seven cervical or neck vertebræ, 12 dorsal and five lumbar vertebræ exist as separate bones. The sacrum (q.v.) and coccyx, forming the terminal part of man's spine, are composed of united vertebræ. The ribs in man correspond in number with the dorsal vertebræ. The limbs consist of homologous or corresponding parts, and are attached to a series of bones constituting the "arch" or support of the fore and hind limbs respectively. The scapulæ or shoulder-blades and collar-bones or clavicles constitute the shoulder-girdle (see SHOULDER-JOINT), or arch supporting the fore or upper limb, while the lower limb is attached to the pelvic arch or pelvis. The upper limb consists of the humerus or bone of the upper arm; the radius and ulna, or bones of the forearm; the carpal or wrist bones; the metacarpal bones, or those of the palm; and the phalanges, or bones of the fingers. The lower limb consists of the femur or thigh-bone; the tibia (shin) and fibula or bones of the leg; the tarsal bones or those of the ankle, corresponding to those of the wrist; the metatarsus or instep; and the phalanges or bones of the toes. See ANATOMY; BONE; OSTEOLOGY.

Skel'ton, John, English poet: b. apparently in Norfolk about 1460; d. London 21 June 1529. He studied at both Oxford and Cambridge, and from both, as well as from the court, he received the laureateship. In 1498 he took holy orders, and subsequently was appointed to the benefice of Diss in Norfolk. In an epistle dedicated to him by Erasmus, that writer declared him to be the *lumen et decus* of British letters. In the pulpit he was remarkable for his buffooneries, and according to Anthony à Wood was esteemed "fitter for the stage than for the pew or pulpit." There were three objects at which he delighted to aim his satire — the mendicant friars, Lily the grammarian, and Cardinal Wolsey. His attacks on Wolsey at length aroused the resentment of that prelate and an order being issued for his apprehension. he took

Digitized by Google

refuge in the sanctuary at Westminster, where the abbot afforded him protection until his death, not long before the fall of Wolsey. His works comprise among others the drama or morality of 'Magnyfycence'; a satire on Wolsey, entitled 'Why come ye not to Courte?'; the 'Tunning (that is the brewing) of Elynor Rummyng,' a humorous picture of low life; and the 'Book of Phylyp Sparrow,' an elegy on the sparrow belonging to the "goodly maid" Jane Scroope, which was killed by a cat. The last is the most poetical of his pieces. It is said that his own opinion,

> Though my rime be ragged,
> Tatter'd and jagged, . . .
> It hath in it some pith.

is reasonably just. The best edition of his works is by the Rev. Alexander Dyce (1843).

Skene, skēn, **William Forbes,** Scottish historian and Celtic scholar: b. Inverie, Invernessshire, 7 June 1809; d. Edinburgh 29 Aug. 1892. He was educated at Saint Andrews and Edinburgh Universities. In 1832 he became a writer to the 'Signet,' and was for some 40 years the head of a prominent legal firm. From an early age he devoted his leisure to archæological and historical research. His chief works include: 'The Highlanders of Scotland, their Origin, History, and Antiquities' (1837); 'The Four Ancient Books of Wales' (1868); and 'Celtic Scotland, a History of Ancient Alban' (1876–80). Besides the above he edited 'The Dean of Lismore's Book, with Introduction and Notes' (1861); 'Ancient Gaelic Poetry'; 'Chronicles of the Picts and Scots, and other Early Memorials of Scottish History' (1867); and Fordun's 'Chronicles of the Scottish Nation' (1871). In 1881 he was appointed historiographer royal for Scotland.

Sker'rett, Joseph Salathiel, American naval officer: b. Chil'licothe, Ohio, 18 Jan. 1833; d. Washington, D. C., 31 Dec. 1896. He was appointed a midshipman in the navy in 1848 and served with the African squadron engaged in the extermination of the slave trade and was on the Saratoga when she captured the Nightingale, the last of the American slavers, with 1,000 slaves on board. He was promoted lieutenant-commander in 1862 and as commander of the gunboat Aroostook of the Western Gulf squadron, successfully attacked the Confederate fortifications at the mouth of the Brazos River, Texas. He was promoted commander in 1867, and in command of the Portsmouth in 1873 averted the threatened revolution in Honolulu. While in charge of the Richmond of the Asiatic squadron in 1881–4 he settled the trouble in which the United States consul at Samoa had become involved. He was on duty at the Naval Asylum in Philadelphia in 1884–6, commander of the Pacific station in 1892–3 and in 1893 became commander of the Asiatic squadron.

Skerryvore, sker-ĭ-vōr', Scotland, an extensive reef lying about 12 miles southwest from the Isle of Tyree on the west coast of Scotland, in the fairway of vessels making for the Clyde and Mersey. The reef was long a danger to navigation until the completion of the celebrated Skerryvore lighthouse in 1844. The tower designed and erected by Alan Stevenson is 137 feet 11 inches in height, 42 feet in diameter at base, decreasing to 16 feet at top. For 26 feet in height the tower is solid. Above the solid the interior is 12 feet in diameter, divided into nine stories, surmounted by a lightroom and lantern. Operations were commenced on the rock in 1838, and the light was exhibited in February 1844; it has a range of 18 nautical miles. The apparatus is dioptric revolving, the light attaining its greatest brilliance once in a minute; the machinery which drives the apparatus is also employed to toll fog bells. The total cost of the work was $434,885.

Sketchley, skĕch'lĭ, **Arthur.** See Rose, George.

Ski, skē. See Skee.

Ski'ascope, the name of a recently invented apparatus for making observations of the influence of the Röntgen rays on a fluorescent screen. A well known form of the skiascope consists of a tapering light-tight box, provided at the narrow end with a closely-fitting open cap of black velvet or other soft dark-colored material into which the face will fit closely and exclude light, and at the other end is fixed the fluorescent screen. On looking through the instrument toward an excited Crookes tube placed near it the screen exhibits fluorescence where the Röntgen rays are not interfered with by objects sufficiently dense to obstruct their passage. When objects that are opaque to the Röntgen rays, such as glass, bones, and most of the metals, are intervened a shadow of them appears on the screen. Thus if the human hand is placed between the tube and the screen the Röntgen rays will penetrate the flesh but be obstructed by the bones, producing a shadow picture of the bones of the hand. See Röntgen Rays.

Skid, or **Skeed,** in lumbering, a long, square piece of timber along which logs are rolled or supported. Also any beam or timber used as a support for some heavy body, to prevent its weight falling on a weak part of the vessel's structure.

Skiddaw, skĭd'â, one of the highest mountains of England, in Cumberland, distinguished for its grand and romantic scenery, as well as for the lakes in its different hollows and near its base: height, 3,022 feet. It is three miles north of Keswick.

Skiff, Frederick James Volney, American exposition-manager: b. Chicopee, Mass., 5 Nov. 1851. He engaged in newspaper work in the West, and during 1885–6 was a member of the Colorado legislature. In 1889 he was appointed commissioner of immigration and statistics for Colorado, and prepared the exhibits of the resources of that State for the Chicago and Saint Louis Expositions 1889–90. In 1890 President Harrison appointed him one of the national commissioners to the World's Columbian Exposition. Subsequently he exchanged this post for that of chief of the department of Mines and Mining and later became deputy director-general. At the close of the Chicago Fair he became director of the Field Columbian Museum, Chicago. He assisted in organizing the Nashville Exposition in 1897 and was a member of the jury of awards; was director-in-chief of the United States exhibits at the Paris Exposition, 1898–1900; and on 15 Sept. 1901 was appointed director of exhibits of the Louisiana Purchase Exposition.

Digitized by Google

Skil'ton, James A., American lawyer and scientist: d. Brooklyn, N. Y., 4 March 1904. He is best known as the friend of Herbert Spencer, to whom he gave much practical aid, and spent thousands of dollars in the purchase and distribution of Spencer's publications. He was a close friend of Henry Ward Beecher, an active worker in Plymouth Church for 45 years and an able writer on economic conditions and the government of great cities.

Skimmia, a genus of evergreen shrubs, of the *Rutaceæ,* native to India and Japan, with green branches, alternate, entire, coriaceous and pellucidly dotted leaves, crowded at the ends of the branches, and small 4- to 5-merous flowers, in much-branched, white and odorless, terminal panicles. *S. japonica* and *S. fortunei* are dwarfed holly-like shrubs, not entirely hardy in the northern United States, but valuable for planting in warmer countries, especially in cities, as they are among the best smoke-enduring evergreens. They are also good for winter gardens, and for Christmas decorations, since they are covered with bright red, berry-like fruits, which hang on during the winter, and contrast handsomely with the dark, shining leaves.

Skimmer, or **Scissors-bill,** an American sea-bird (*Rhynchops nigra*), related to the gulls, and distinguished by the long, thin, knife-like bill. See SHEARWATER.

Skim'mington, a word used in England, in the phrase, «To ride skimmington,» or «To ride the skimmington,» a burlesque procession in ridicule of a man who allowed himself to be henpecked. The man rode behind the woman, with his face to the horse's tail.

Skin and Skin Diseases. The skin is the vital organ which forms the outer covering of the body. It may be regarded as an extensive, complex, uninterrupted membrane, actively functionating, and merging into the mucous membranes at the natural orifices of the body. Beneath it stands in the most intimate structural relationship to the underlying tissues; externally it is exposed to varied and innumerable contacts with the outer world. By reason of this unique position as the boundary of the living organism, the skin has important functions to perform, all of which are contributory to the well-being of the individual, while some are essential to his continued existence.

To the touch the skin in general is approximately smooth, soft, supple, and movable upon the underlying tissues. In certain localities — those subject to special contacts, as the palms and soles — it is more dense and less pliable than elsewhere. Inspection discloses the presence of various surface markings in the form of minute pores and intersecting lines, furrows, and ridges. There is also seen an extensive but variable growth of hair, and at the end of the dorsal portions of the fingers and toes are the horny structures known as the nails. The pores represent the combined openings of the sebaceous glands and the hair-follicles, and as such give exit to the hair-shafts. The lines and furrows of the skin are primarily the product of its elasticity. They are fine, intermediate, and coarse. The last type is best seen about the joints, or upon the palms, where by reason of great latitude of movement, the skin is often thrown into folds; the other types occur upon those parts less subject to wide range of motion. The ridges are best observed upon the palms and soles, appearing in curved and straight, more or less parallel formation, said to be characteristic in each individual. Hair is quite generally distributed over the body surface, though certain parts are free; the amount and quality vary greatly with the location. The nails, though unlike the skin in texture and appearance, are entirely derived from the dermal tissues.

Anatomy of the Skin.— Technically in description the term skin includes only the cellular and connective-tissue layers, with their blood-vessels and nerves. The highly differentiated structures which by derivation, function, and position are a part of the skin, as the sebaceous and sweat glands, hairs, hair-follicles, and nails, are termed appendages of the skin. From within outward the skin proper is made up of three layers: the subcutaneous tissue or hypoderm; the corium or true skin, called also the cutis or derma; and the epidermis, cuticle, or scarfskin. The hypoderm can scarcely be considered a distinct layer; it is more properly a connecting bond between the body tissues internally and the corium externally. It is loose in texture, and is composed of interlacing fibrils and bundles of connective tissue, more or less obliquely directed, within the wide meshes of which are deposited masses of fat. This fatty tissue in the hypoderm forms the panniculus adiposus, and to it is due the rounded contour of the well-nourished body. Its disappearance by absorption following prolonged illness, and in old age, produces angularity of feature and wrinkling of the skin. Besides blood-vessels, lymphatics, and nerves, this layer contains sweat-glands, deep hair-follicles, and special nerve-endings. The corium, cutis, or derma, is made up in general of a more or less dense network of fibrous and elastic tissue, carrying within it vessels, nerves, glands, hair, and hair-follicles. It is divided into two layers; the pars reticularis and the pars papillaris; but the dividing line between the two is not clear-cut. The pars reticularis is the layer in contact with the subcutaneous tissue. It is well described by its name — a reticulum of loose connective tissue. The pars papillaris is relatively much thinner, but more dense than the pars reticularis, and lies external to the latter. It derives its name from the fact that its outermost portion presents innumerable papilla-like projections, which interdigitate with corresponding downward prolongations from the innermost layer of the epidemis. The total number of papillæ upon the body surface is enormous; an estimation of approximately 64,000 to the square inch has been made. The curved and parallel ridges previously mentioned as seen upon the palms are due to an arrangement of papillæ in rows. Each papilla is provided with a vascular loop or a special nerve-ending; rarely both are present. The proportion of the vascular to the nervous variety is about four to one; hence it is that the especially sensitive areas of the skin contain the greater number of papillæ.

The epidermis or cuticle is the portion of the skin intervening between the corium and the external world. Though structurally in most intimate relation with the true skin, by

Digitized by Google

derivation it is totally distinct from it, being developed from the epiblast of the embryo, whereas the corium springs from the mesoblast. As the epidermis is avascular, nourishment is provided by means of juice-spaces in the deeper portions. The lower cells are therefore soft and succulent, and the extent of the change necessary to transform them into the dry, horny, and flat cells of the skin surface is readily apparent. For description the epidermis is divided from within outward into four layers, the stratum mucosum, the stratum granulosum, the stratum lucidum, and the stratum corneum. The stratum mucosum, called also the rete mucosum or Malpighii, the mucous or prickle layer, consists of several superimposed strata of cells, which fill in the interpapillary spaces of the corium, and present an undulating, plane surface to the layer next above. The cells in general are rich in protoplasm, have clearly defined nuclei, are columnar and polygonal in shape, becoming flattened as the surface is approached, and are provided with radiating, spine-like, protoplasmic processes or «prickles,» which anastomose and interdigitate one with another. A viscid intercellular cement-substance is present, permeated by channels for the passage of nutritive fluids. The layer of cells in immediate contact with the corium has been aptly termed the stratum germinativum, since it is by multiplication of these that both physiologic exfoliation and pathologic loss of the epidermis are restored. The pigment which gives color to the skin is found in this layer, and nerve fibrils are abundantly present between and within the cells. The stratum granulosum is a narrow band of cells distinguished by the appearance of granules within the cell protoplasm. These are highly refractile, and are composed of keratohyalin, a substance believed by some to be the antecedent of keratin, the horny material in the cells of the skin surface. The stratum lucidum is also narrow, and is made up of more or less flattened cells, with faint nuclei and a homogeneous and lucid-appearing protoplasm. The granules of the preceding layer have totally disappeared, and instead a substance called eleidin is found diffused throughout the cell body. This is regarded by some as a solution of the keratohyalin in the cell protoplasm. Others consider it a totally distinct body and not related to the product keratin. The stratum corneum is the must superficial layer. It is relatively thick, and its component cells are flat, dry, horny, and resistant, from the presence of keratin. Nuclei are absent or very faintly outlined. By special treatment the remains of the «prickles» may be detected. A well-grounded assertion has been made that the succulent protoplasmic spicules of the rete, by desiccation and other change, give origin to the keratin of the corneum. Constant exfoliation of the superficial cells of the skin is in progress, the loss of substance being compensated by growth from below.

The vascular supply of the skin is abundant. The numerous arterial branches emerging from the deeper tissues divide and subdivide to form an intricate horizontal network of vessels in the subcutaneous tissue. A second plexus is formed by division of radicles from the first at about the level of the papillary bases. From these arterioles capillary loops extend into the papillæ. The distribution of veins and venules for the return of the blood is practically the same as that of the vessels for the arterial flow; the venous channels, however, are considerably larger. For the passage of lymph, juice-spaces and lymph-vessels exist. The former are mere excavations in the intercellular cement-substance, communicating with one another, and eventually emptying into lymphatic vessels. These latter are channels with definite endothelial walls; they appear first at the bases of the papillæ as blind terminals, and by anastomoses form dense plexuses in the corium and subcutaneous tissues. The vessels receive the lymph from the juice-spaces through openings between the vascular endothelia, and eventually discharge their contents into the veins. The lymph which nourishes the epidermis flows from the papillary apices, percolates between the cells of the rete, and returns by way of the interpapillary spaces.

The nerves of the skin are medullated and non-medullated. The latter form a dense plexus immediately beneath the rete mucosum; thence fibrils ascend, penetrating as far as the granular layer, and terminating either within or between the cells of the rete. Special nerves of non-medullated variety, known as vaso-motor nerves, are distributed to the muscle-fibres of the vessel-walls. The medullated nerves are confined to the papillary and subcutaneous layers, and are peculiar in that they terminate in special end-organs. Three varieties of these are found in man: the corpuscles of Krause, the corpuscles of Meisner, and the Paccinian corpuscles. While these differ in minute structure, in general all may be described as round or oval bodies, made up of concentric layers of connective tissue, enclosing the blunt or coiled termination of a nerve which enters at one pole of the mass. The first two kinds are found within and beneath the papillæ, especially in sensitive parts, while the Paccinian corpuscles occur in the subcutaneous tissue throughout the body. Trophic nerves are present in the skin, but are not anatomically demonstrable. Muscle-fibres of the smooth or unstriped variety are found in the corium of certain parts, especially the face. The principal muscular structures in the skin, however, are the arrectores pilorum. These are smooth muscle-bundles which arise from the lower portion of the walls of the hair-follicles and extend obliquely upward to be inserted into the pars papillaris of the corium. Contraction of these muscles produces erection of the hair, or on the glabrous skin the condition known as «goose flesh.» The pigment of the skin resides in the lower cells of the rete mucosum. It appears as black granules of melanin within the cell protoplasm, chiefly about the nuclei. In the dark races the pigment is found in the superficial cells, in some cases even in the corneum. The tint of the skin is also influenced by vascularity. Many theories have been advanced as to the origin of the skin pigment; it seems most probable that it is derived from the coloring matter of the blood in the corium, and thence carried to the rete by wandering cells. Two kinds of glands exist in the skin: the coil, sweat, or sudoriparous glands, and the sebaceous or oil glands. The sweat-

Digitized by Google

glands are found in the hypoderm and lowermost portion of the corium. Each consists of a single long tubule, with a blind extremity, coiled many times upon itself to form a round or oval mass, from the upper part of which the excretory duct ascends. This is merely a straight portion of the tube slightly modified; it enters the rete opposite an interpapillary space, and after an irregular and spiral course through the epidermis opens upon the free surface of the skin, forming the sweat-pore. Besides the single layer of secretory cells, an investing membrane, unstriped muscle fibres and nerve filaments compose the tubule, and many blood-vessels are distributed in and about the coils. The duct has a lining of several layers of cells, and a more distinct investing membrane; in the rete these disappear, and through the corneum no definite lining exists. The sebaceous or oil glands are usually found in connection with the hair-follicles, but may occur where hair is absent, as on the lips. Their seat is the corium; each consists of one or several, sometimes many, pear-shaped lobules, lined with epithelium and invested with fibrous tissue. All the lobules open into a common gland-cavity, which in turn discharges into the upper portion of a hair-follicle. The product of the gland, called sebum, is formed by fatty degeneration of the epithelial cells within the lobules; its extrusion is favored by the contraction of the arrector pilorum, which compresses the gland against the hair root.

Hairs, though quite generally distributed, are absent on the palms, soles, the dorsum of the last phalanges of the fingers and toes, and the lips. They vary greatly in amount, quality, and distribution, these being influenced by age, sex, climate, racial and individual peculiarities. A separation of hairs into three classes may be made: long hairs, over two inches in length, found on the scalp, axillæ, pubes, and bearded portion of the face; bristle hairs, short and stiff, as those comprising the eyebrow and eyelashes; and downy hairs or lanugo, short fine, and soft, found on parts of the face, the trunk, and the extremities. Each hair may be divided into two parts: the shaft, or portion projecting above the skin surface, and the root, or part imbedded in the skin. The shaft is made up of the cuticle, a single layer of imbricated cells covering the exterior; the cortex or main body of the hair, composed of spindle-cells, massed into elongated bundles; and the medulla or pith, of irregular cells containing air-vesicles. The color of hair is due to the presence of granular and diffuse pigment in the cortical substance, and to air in the cortex and the medulla. The hair-root is seated within the hair-follicle; its extremity is expanded into the hair-bulb, which is invaginated by the hair-papillæ, carrying a vascular supply. In the hair-root the cells comprising the layers mentioned are softer, and more nearly approach the character of the rete-cells, from which the hair is derived. The hair-follicle is the elongated pouch-like depression which receives the hair-root. It is usually obliquely set, and in detail of structure is rather complex. A better understanding of its formation may be had if it be remembered that the follicle is merely an invagination of the skin-layers; the outer portion, therefore, is made up of the derma, while the inner layers are furnished by the epidermis. Hence a dermic coat and an epidermic coat are distinguished. Each of these is further divided into layers: the dermic coat into three, namely, an external, fibrous and vascular; a middle, fibrous, possibly muscular in part; and an internal, thin and hyalin. The epidermic coat has several layers, the nomenclature of which is not entirely fixed. These, too, are quite complex in structure and for practical purposes a division without description into the outer root-sheath, the inner root-sheath, and the cuticle of the root-sheath will suffice. The first two are by some regarded as a part of the hair proper. These strata are derived entirely from the rete mucosum by differentiation; the corneum does not enter the follicle beyond the opening of the sebaceous gland.

The horny formations upon the distal portions of the dorsum of the fingers and toes are strangely unlike the general skin in appearance, yet they are derived directly from the cells of the rete mucosum. For description, the nail is divided into two parts: the nail-body, or uncovered portion, and the nail-root, or portion imbedded in the tissues. The entire nail rests upon the nail bed or couch. The part beneath the *nail*-root is known as the matrix. The depression into which the nail is set posteriorly and laterally is the nail-groove. The skin overlying the imbedded portions is the nail-fold, and the adherent film extending onto the nail-body from the nail-fold is termed the nail-skin. The lunula, the white curved border seen at the base of the nail, represents the distal border of the matrix. The tissues beneath the nail are dense and vascular, but are poorly supplied with nerves. The papillæ are numerous, and their arrangement in rows produces the longitudinal striæ seen on the surface of the nail. The hypoderm is devoid of fat, and is closely adherent to the periosteum of the phalanx, thus presenting a solid foundation upon which the nail may rest. Growth takes place from the matrix; although the rete mucosum underlies the entire nail, only the rete-cells of the matrix undergo the transformation into horny nail-substance.

Physiology of the Skin.— The complex histological structure of the skin and its appendages is necessitated by physiological requirements. As the living encasement of the body, its functions are necessarily related to external and internal factors. Thus it protects the organism from harmful influences from without; it provides a sense-organ that is necessary to a correct interpretation of the external world; it contributes largely to the regulation and conservation of body heat; and it removes from the organism quantities of waste and harmful material. All the dermal structures participate in the protective function of the skin. The connective and adipose tissue of the hypoderm; the dense fibrous and elastic meshwork of the corium; and the horny cells of the epidermis, rendered unctuous by glandular secretion, are together admirably adapted to guard the deeper structures from injury by mechanical violence, to prevent undue loss of heat and fluids from within, and to resist the penetrating or destructive action of fluids from without. The hair in man, especially on certain parts, is protective from violence and thermal change, but not to the same degree as in animals; in them it is obvious that the fur,

Digitized by Google

composed of densely set hairy filaments distributed over the entire body, must act as a potent agent in turning aside harmful encroachments from the exterior, and in conserving body heat. The cutaneous nerves contribute to protection in that the sensibility of the skin may warn the individual of possible dangerous contacts, often in time to prevent harm.

Sensation in the skin is provided for by the presence in abundance of nervous filaments and special nerve end-organs. Although many kinds of sensations are perceived through the skin, the exact part performed by each of the several varieties of nerve-terminations is not fully known as yet. By means of the tactile sense the individual is able to judge the shape of an object in contact, and the portion of the skin touched by it; he can appreciate its weight, and recognize whether it is hot or cold. These varieties of tactile sense — locality sense, pressure sense, and temperature sense — are probably not resident in one and the same variety of nerve or nerve-termination. Pain has been considered an overstimulation of sensory fibres; experimentation, however, seems to show that special nerves are concerned when pain is felt. The skin through perception of pressure and tension, is in part responsible for muscular sense, by means of which the individual is cognizant, without the aid of the eye, of the position of his body with reference to surroundings. Special sensations, as itching, burning, tickling, creeping, etc., are perceived through the skin, but the nerves concerned in their reception and conduction are not known.

The skin plays an important role in the regulation of bodily temperature. The action of excessive heat, from within or without, upon the vasomotor nerves distributed to the blood-vessels of the skin, causes the latter to dilate. An increased amount of blood is thus brought to the skin, where it is cooled by conduction and radiation, and also by evaporation. The latter effect results from the increase of moisture on the skin, following an acceleration of sweat-gland secretion, due to augmented blood-supply. On the other hand, cold, acting upon the vasomotors, leads to contraction of the vessels; a diminished amount of blood enters the skin; evaporation is reduced by the checking of sweat secretion; and bodily heat is conserved.

The secretory and excretory functions of the skin are carried on by the sebaceous and sweat glands. The product of the former, a fatty, unctuous material, cannot be strictly regarded as a secretion. Its purpose rather is to anoint the hair and skin, thus keeping the latter soft and preventing heat loss by evaporation, and maceration of the epidermis by moisture. The sweat, however, is a true excretion, and as organs for the removal of waste products the sweat-glands are most important. Various estimations have been made of the amount of sweat produced in 24 hours; the average is probably about 1½ pounds. This can be greatly increased by muscular activity, by high external temperature, and by the use of certain drugs; it is obvious, therefore, that considerable material can be removed from the body through the skin, a fact of great importance in the treatment of certain diseases. The sweat itself is about 99 per cent water; the remaining 1 per cent represents a number of complex fatty bodies and mineral salts. It may be alkaline or acid in reaction; acidity is in part due to admixture of fatty acids from the sebaceous secretion. It has been claimed that the sweat-glands produce no fat, but it is generally accepted now that this is not true, since the secretion in the palm, a part devoid of sebaceous glands, unquestionably contains fatty products.

The skin possesses a respiratory function, but it is comparatively insignificant. Carbonic acid gas is given off, and oxygen absorbed, the relative amounts of each as compared with those from the lungs, being 1-220 of the former, and 1-135 of the latter. The interchange probably takes place through the sweat-pores. The skin also exhibits a certain degree of absorptive power. This is but slight in the undamaged skin. If the horny layer be removed, or if the substance be forced into the glandular ducts, absorption may take place readily, especially of certain substances.

Diseases of the Skin.— Abnormal or diseased conditions of the skin, as of other organs, are recognized by manifestations called symptoms. These are all referable to one of two categories: subjective symptoms and objective symptoms. By the former is meant those which are appreciated only by the patient himself; by the latter, those which may be detected by the examining physician. Subjective symptoms in purely cutaneous diseases are, in many instances, wanting; when present they are manifested in some form of abnormal sensation, as burning, prickling, tingling, smarting, creeping, or itching; in diminished sensibility or anæsthesia; in increased sensibility or hyperæsthesia; or in pain, which latter may be burning, shooting, boring, or aching. Of all subjective symptoms, itching or pruritus is most common; it is constantly present in many conditions, though often in varying degree.

Objective symptoms are vastly more important. To the person afflicted they often seem the visible manifestations of disfiguring, repulsive disease, and their appearance is therefore dreaded; to the dermatologist they stand for facts and principles which, when aggregated, constitute the major portion of his special knowledge, and which he must know and understand most thoroughly if he shall hope to be proficient. Any alteration from the normal in the texture and appearance of the skin is termed a lesion. Lesions are variable in appearance, character, and manner of evolution, which fact is the basis of their subdivision into two general classes: elementary or primary lesions; and consecutive or secondary lesions. These terms are self-explanatory; the former are lesions which at their inception present a certain type; the latter are those which are produced by progressive alteration from a previously existing type. The classification is not entirely accurate, however, for under certain conditions a lesion of a primary type may appear as secondary. Briefly described, the objective cutaneous characters, which are considered primary, eight in number, are: (1) Macules (spots or stains), circumscribed alterations in the color of the skin, without elevation or depression of the surface. They are variable in size, shape, color, duration, and as to cause of the dyschromia. A familiar example is the "freckle." (2) Papules (pimples), small, usually superficial, pinhead to pea sized,

Digitized by Google

circumscribed, solid elevations of the skin. These, too, differ in size, shape, color, duration and cause. The "pimples" or papules of acne in young persons, illustrate this type of lesions. (3) Tubercles (nodules), solid, fairly circumscribed, pea-sized, deep-seated elevations, usually persistent in character. These are in reality large papules, or more properly, intermediate lesions between the papule and the tumor, to be next described. In severe acne tubercles are sometimes found. (4) Tumors, soft or firm, more or less circumscribed elevations of the skin, varying in size and shape, and seated deeply, in the corium and subcutaneous tissues. As the papule merges into the tubercle, so the tubercle passes over into the tumor; thus at one extremity of the series stands the pinhead-sized papule, at the other, the egg-sized or larger tumor. (5) Wheals, circumscribed, reddish-white, œdematous elevations of variable size and shape, usually evanescent in character. This form of lesion occurs typically in the condition known as urticaria (q.v.) or nettle-rash. It is angioneurotic in origin and is always accompanied with subjective symptoms, especially itching. (6) Vesicles (little blisters), circumscribed elevations of the horny layer of the epidermis, pin-point to pea sized, with limpid, lactescent or sanguinolent contents. This form of lesion may at times be secondary, since it can develop on a previously existing papule, as illustrated in smallpox. (7) Pustules, pin-point to filbert sized, circumscribed cutaneous abscesses, having an epidermal roof-wall. The skin surrounding the base usually shows an inflammatory areola. They are developed very frequently from vesicles, less often from papules. It is, in fact, somewhat questionable to class the pustule as a primary lesion. They are seen commonly in acne. (8) Blebs (large blisters), irregularly shaped elevations of the epidermis, varying in size from a pea to a goose egg, containing clear or opaque fluid. This leison is well illustrated by the blister following a severe burn.

The secondary or consecutive lesions of the skin, six in number, are: (1) Excoriations (abrasions, scratch-marks), variously sized and shaped areas, representing loss of superficial cutaneous tissue, the result of mechanical violence. (2) Fissures, linear cracks or wounds of variable size, involving the epidermis, or the epidermis and corium, due to disease or external injury. These are seen not infrequently in the palms, or about the angles of the mouth, when from any cause the parts have become inelastic. (3) Scales, dry, laminated, masses of epidermis which have separated from the underlying tissue as the result of some morbid process. They may lie in masses upon the skin, or be constantly exfoliated from the surface. Variations occur in color, consistency, and form. (4) Crusts (scabs), dried, effete masses of exudation, mixed with epithelial debris, varying in size, shape, and color. (5) Ulcers, variously sized and shaped losses of cutaneous substance, the result of preceding disease. In this form of lesion, differences are found in size, outline, depth, condition of floor, margins, etc. A familiar example is the leg ulcer in old people. (6) Scars, new connective-tissue formations replacing loss of substance in the corium or deeper tissues.

Besides recognizing the presence and detailed appearance of the lesions upon the skin, the diagnostician must also note their distribution upon the body surface, their general arrangement, and their configuration when grouped together. All these considerations help to elucidate the condition present.

In the etiology of skin diseases many factors are operative. For convenience of description these may be classed as internal causes and external causes. Among internal causes, heredity may be mentioned first. While not many cutaneous diseases are inherited, the predisposition to them may undoubtedly be passed on to the child. This predisposition probably is due to some form of tissue vulnerability to influences which otherwise might not suffice to produce disease. Disorders of internal organs are frequently effective. Their exact relation to the skin disorder may not be entirely clear; but the joint association of internal and cutaneous disease in many instances is too regular and frequent to be a mere coincidence. Thus, gastro-intestinal derangements may produce erythema, eczema or urticaria; kidney disease may originate an eczema or pruritus; diabetes is not infrequently accompanied with boils, carbuncles, gangrene, dermatitis, urticaria, or pruritus. Syphilis is attended with many forms of eruption; gout is frequently associated with eczema or psoriasis, and rheumatism with erythema and purpura. Asthma, eczema, and urticaria are often found together. Lastly, nervous derangements may produce an array of functional disturbances in the skin, and through reflex action on the vasomotor nerves may be the determining factor in the development of cutaneous lesions. The sexual system unquestionably exerts an influence on skin diseases. The prevalence of acne in the young, following puberty, is well known, and various cutaneous derangements are associated with physiologic crises and pelvic disorders in women. Food may produce skin eruptions. Urticaria is not uncommon after ingestion of shell-fish, cheese, or strawberries, and the list of skin-irritating articles could be greatly extended. Eczema, acne, and inflammatory conditions are greatly influenced by quantity and kind of food taken. Alcohol in inflammatory lesions is especially harmful.

Any of the many types of skin eruptions may develop following the use of certain drugs, the list of which is very extensive. Among those in most common use which may disturb the skin, are quinine, belladonna, morphine, arsenic, potassium bromide and iodide.

Climate may be considered an external factor. Warmth and moisture found in tropical and subtropical countries are especially favorable to the growth of certain parasites in the skin. Cold and moisture tend to induce eczematous conditions. Certain diseases are distinctly prevalent in certain countries, but the fact is not always due to climatic influence alone. The seasons differ also in their effect. Winter aggravates pruritus, eczema, and psoriasis; summer improves them. Light, heat, and cold are capable of producing inflammatory conditions. On the other hand, light is distinctly ameliorative in certain diseases, as psoriasis. Clothing, when improper in amount, harsh of quality, poorly fitting, or uncleanly, can give rise to inflammation of the skin. Irritants of various sorts, whether

Digitized by Google

mechanical, chemical or medicinal, can likewise awaken inflammation. Scratching and other traumatism are frequent causes of hyperæmia and dermatitis. Parasites, both vegetable and animal, are the most important of all external causes. A very large number of cutaneous diseases are traceable to them. Among the more common diseases produced by vegetable organisms are boils, carbuncles, various pus infections, and the different forms of ringworm; by animal parasites, scabies, and dermatitis from pediculi.

The number of cutaneous disorders under classification is about 170, but this does not include all tropical diseases. Of this seemingly large number, many are rare, others are seen but seldom, while a few are very common. Dermatologists have not agreed upon a uniform classification of skin diseases; their differences, however, largely concern minor distinctions. The following general classes are usually given as a basis for further subdivision: (1) hyperæmias; (2) inflammations; (3) hemorrhages; (4) hypertrophies; (5) atrophies; (6) new growths; (7) neuroses; (8) diseases of the appendages; (9) parasitic affections. By some authorities diseases of the appendages are considered among the other classes, as inflammations, hypertrophies, etc. The difference in the classification, however, is not essential, being rather one of convenience. For further discussion of the subject the following authorities, among others, may be consulted: Hyde and Montgomery, 'Diseases of the Skin,' (Phil. 1904); Stelwagon, 'Diseases of the Skin' (Phil. 1903); Crocker, 'Diseases of the Skin' (Phil. 1903); Mrăcek, 'Handbuch der Hautkrankheiten' (Vienna 1902); 'La Pratique Dermatologique' (Paris 1904).

ERNEST L. MCEWEN, M.S., M.D.,
Associate Instructor in Dermatology, Rush Medical College, Chicago.

Skin-grafting, the surgical procedure of covering over areas of the body denuded of skin. It may be rendered imperative by the great extent of surface so denuded, or by disabling or disfiguring contraction. Reverdin's method consists in applying to the raw clean surface small points of superficial epithelium. From these centres a new skin is formed. Thirsch's method consists in covering the raw surface with strips of skin of variable length and width cut from another part of the patient's body or from the body of another individual.

Skink, a genus (*Scincus*) of lizards of the cosmopolitan family *Scincidæ,* characterized by a conical head, with well developed eyelids, and covered with symmetrical shields. The body is protected by bony plates underlying the scales. No thigh pores exist, and in some genera the limbs may be hidden beneath the skin. In the genus *Scincus* itself the scales are of thin and smooth texture, and the tail is rounded and tapering, and is unprovided with spines. The body is somewhat spindle-shaped, and is flat below. Five toes exist on each foot, and the toes are of flattened shape and fringed on the sides. The palate is grooved longitudinally, and is provided with teeth. The common skink (*Scincus officinalis*) occurs in North Africa, and in India. It inhabits sandy places, and when alarmed burrows swiftly beneath the sand. Its specific name is derived from the fact that formerly it was thought to possess valuable medicinal properties, and among savage tribes it is regarded as an antidote to poison. In classic ages its virtues were much reputed, and the head and feet of these lizards were imported to Rome in large quantities preserved in white wine. Its color is a variable reddish, marked above with cross bands of darker hue, while below it is of a white color, tinged with silvery lustre. The average length is from 6 to 7 inches. The family is represented in the United States by several genera, of which *Eumeces* is the most prominent and is represented by several well known species. Consult: Holbrook, 'North American Herpetology' (Philadelphia 1848); Cope, 'Crocodilians, Lizards and Snakes' (Washington 1900); Gadow, 'Amphibia and Reptiles' (New York 1901).

Skinner, skĭn'ėr, **Aaron Nichols,** American astronomer: b. Boston, Mass., 10 Aug. 1845. He was educated at Beloit College, Wis., and at the University of Chicago, was assistant at the Dearborn Observatory, Chicago, in 1867–70, and assistant astronomer at the United States Naval Observatory in 1870–90, since when he has been professor of mathematics in the United States Navy. He has made numerous valuable astronomical investigations, was in charge of the 9-inch transit circle in the United States Naval Observatory in 1893–1902 and in 1901 conducted the government expedition to Sumatra to observe the solar eclipse of 17 May 1901. He has published 'Washington Zone Observations.'

Skinner, Charles Montgomery, American journalist and author: b. Victor, N. Y., 15 March 1852. He early entered upon a journalistic career and is at present (1904) associate editor of the Brooklyn *Eagle*. He represented the *Eagle* on the relief expedition of the Dixie to Martinique in 1902. The drama 'Villon, the Vagabond' played by his brother, Otis Skinner, is from his pen, and he has also published: 'Nature in a City Yard' (1897); 'Do-Nothing Days' (1899); 'Flowers in the Pave' (1900); 'Prisons of the Nation and Their Inmates' (1902); 'American Myths and Legends' (1903); etc.

Skinner, John, Scottish song writer: b. Balfour, Aberdeenshire, 3 Oct. 1721; d. Aberdeen 16 June 1807. He was educated at Marischal College, Aberdeen; taught school for a time; took orders in 1742 in the Scottish Episcopal Church and settled at Longside, Aberdeenshire. He suffered during the period of persecution of Jacobite ministers after 1745–6 and in 1753 spent six months in prison for preaching in his own house. He is remembered for his songs, which placed him in the estimation of Burns, as one of the foremost of Scottish song writers. Among these are: 'Tullochgorum'; 'Ewie wi the Crookit Horn'; 'John o' Badenyon'; 'The Marquis of Huntly's Reel'; 'Lizzie Liberty'; and 'The Old Man's Song.' His prose included: 'A Preservative against Presbytery' (1746); 'Dissertation on Job's Prophecy' (1757); 'Ecclesiastical History of Scotland' (1788). His 'Songs and Poems' edited by Reid appeared in 1859.

Skinner, Otis, American actor: b. Cambridge, Mass., 1858. He made his début Nov. 1877 as Jim in 'Woodleigh' at the Philadelphia

Digitized by Google

Museum; New York début at Niblo's Theatre 1879. Assumed important roles with Lawrence Barrett, Augustin Daly and Mme. Modjeska. Since 1902 he has been prominent as a star in romantic plays.

Skinner, William, American manufacturer: b. London, England, 1824; d. Holyoke, Mass., 28 Feb. 1902. He came to the United States in 1845 and settled in Northampton, Mass., where he engaged in the silk business. He became a partner in a silk manufacturing firm in 1848 and in 1851 established a business of his own at Williamsburg, Mass. His factories being destroyed by the Mill River flood in 1874, he rebuilt them in the same year at Holyoke. He was actively engaged in philanthropic work, was a generous benefactor of Vassar, Smith, and Holyoke colleges, built a gymnasium for Dwight L. Moody's school in Northfield, Mass., was president of the local city hospital and also of the Manufacturers' Association of Holyoke.

Skinners, bands of marauders, adherents to the American cause who infested what was considered neutral ground along the Hudson River in New York State, during the American War of the Revolution. The Skinners carried on a vigorous guerrilla warfare, being opposed by the Cow-boys, as the marauding adherents to the British cause were called. In some instances the Skinners did serviceable work for the American army, harassing small detachments of British soldiery, scouting and foraging parties, and acting as scouts for the Americans when occasion demanded. It was a party of three Skinners who intercepted André (q.v.) on his way back to New York, after receiving treasonous papers from Benedict Arnold (q.v.) at West Point. This was the chief service performed by the Skinners, who, like the Cowboys, operated principally in Westchester County and were not particularly scrupulous as to the party to which their victims belonged.

Skipper, a butterfly of the family *Hesperidæ*. The body is short and thick, head large, eyes prominent, antennæ short, with the knob curved like a hook or bent to one side, legs six, and the four hindmost shanks armed with two pairs of spurs. Skippers are generally rich brown, marked with yellow spots. The species are quite numerous, and expand from 1½ to 2½ inches. They owe their name to their jerky flight.

Skir'mishers are soldiers acting in loose array in front and on the sides of an army. It is the duty of the skirmishers to cover the line of advance of an army and to guard its flanks, so as to protect against surprise by the enemy. The skirmishers usually operate considerably in advance of the main body, from a mile to five miles, advancing in files of two men, front and rear, with a distance of about six paces between them. Skirmishers fire independently and at their own discretion and in modern warfare do not adhere strictly to the rules of the tactics, either as to their disposition or as to alternating, between the files, in firing. Skirmishers are frequently used to draw on a battle or to cover the movement of the main body in their rear. When attacked by cavalry in open ground the skirmishers are supposed to close up ranks, forming what are known as rally squares. The manual of infantry tactics provides that every company of skirmishers shall have a small reserve, whose duty it is to fill vacant places and furnish the line with cartridges, and to relieve the fatigued. Consult Upton's 'Manual of Infantry Tactics.'

Skirret, a hardy perennial umbelliferous plant (*Sium sisarum*) about four feet high, with pinnate leaves and tiny white flowers in compound umbels. It is indigenous to Asia, and has been cultivated in rich, moist soil, for its edible, fleshy tubers, which are about as thick as a finger and grow in clusters, united at the base of the stem, and are long, cylindrical, and somewhat jointed. They have a sweetish taste, resembling parsnips, are somewhat floury, and should be tender, except for a woody core, which must be removed before cooking. It is a winter vegetable, boiled and served like salsify, but is of minor importance at present.

Skitsuish. See SALISHAN INDIANS.

Skittles, a favorite game in England much resembling the American game of bowls (q.v.). It is played in a covered skittle-alley, usually indoors. Nine skittles or large wooden pins about a foot high with flat bottoms are set upright at one end of the alley a foot apart. They are arranged in a square, three skittles to a side and one angle of this square is turned toward the player, or thrower, who stands at the other end of the alley, 21 feet away. The thrower uses a large wooden ball, about a foot in diameter, which he throws along the floor of the alley with sufficient force to bowl over the pins at the other end; the thrower is allowed to advance but one step in the act of throwing. The object of the game is to knock down all or as many of the skittles as possible, each throw counting so many points, and the one who makes the greatest number of points in a given number of throws wins the game. The game of skittles was introduced into England under the name of Kails in the 14th century, having been brought over from the French. It is still popular and is known in some places under the name of Ninepins, from the number of skittles used.

Sklallam. See SALISHAN INDIANS.

Skobeleff, skō'bĕ-lyĕf, **Mikhail Dimitrievich,** Russian general: b. near Moscow October 1844; d. Moscow 7 July 1882. He entered the army and served in Poland in the suppression of the insurrection of 1863–4; and later in the campaigns in the Caucasus and in Central Asia. In 1873 he was attached as colonel to Gen. Kaufmann's staff when the city of Khiva was taken, and in 1875 commanded the expedition against Khokand. This province being annexed in 1876 with its name changed to Ferghana, Skobeleff was appointed military governor; but at the outbreak of the Turkish war he hastened to the front, crossing the Danube on horseback. He held no commission until the second attack on Plevna in 1877 when he led three regiments, but was forced to sacrifice the advantage he had gained for lack of support. Being appointed lieutenant-general, he commanded the famous 16th Division, with whom he turned back the left flank of the Turkish army at the passage of the Balkans and captured Shenova after Mirsky and Raditsky had failed. He led the advance upon Adrianople in

Digitized by Google

1878. His last military exploit was as commander of the expedition against the Tekke-Turkomans in 1880–1 and the conquest of Gök-Tepe on 12 January. He was promoted to the rank of general after the campaign.

Skoda Gun. See ORDNANCE.

Skoko'mish. See SALISHAN INDIANS.

Skopt'zi, or **Skoptsy,** a religious sect founded in Russia in the latter part of the 18th century by Kondratiy Seliwanoff. His followers practise castration in the belief that it will purify their souls and render them fit to enter heaven. Since 1869, when their practices were discovered by the Russian government, attempts have been made to suppress the sect by penal measures, but it is still believed to include a number of influential persons in its following. See also RELIGIOUS SECTS.

Skowhegan, skow-hē'gan, Maine, town, county-seat of Somerset County; on the Kennebec River, and on the Maine Central Railroad, 45 miles west of Bangor. The first settlement in this vicinity was made in 1792; Skowhegan was at first a part of the town of Canaan, but was separately incorporated in 1823 under the name of Milburn; in 1836 it was given its present name, which is the ancient Indian name for the place. The town of Bloomfield was annexed in 1861. The Kennebec here has a perpendicular fall of 30 feet, and this furnishes excellent water-power. The census of 1900 reported 69 manufacturing establishments in the town, with a capital of $941,681; they include lumber, pulp, flour, and woolen mills, shoe factories, and manufactories of scythes, axes, etc., and oil-cloth. There are two national banks with a combined capital of $275,000. The town has a high school, and a public library (founded 1867). Pop. (1910) 5,341.

Skrine, John Huntley, English clergyman and author: b. Somerset, England, 4 April 1848. He was educated at Oxford, ordained a priest in the Church of England in 1874, and in 1873–87 was assistant master at Uppingham. He was warden of Trinity College, Glenalmond, in 1888–1902 and in 1897 he was appointed canon of Perth Cathedral. He has published: 'Margaret of Anjou' (1870); 'Under Two Queens,' lyrics (1884); 'A Memory of Edward Thring' (1890); 'The Queen's Highway,' lyrics of the war (1900); 'Pastor Agnorum, A Schoolmaster's After-thoughts' (1901); 'The Mountain Mother,' sermons (1902); etc.

Sku'as and Jægers, a large gull of the genera *Stercorarius* and *Megalestris,* and especially of the latter, the former being more often called «jægers.» They are usually classed as a sub-family of *Laridæ* (q.v.). They are predatory birds, rarely fishing for themselves, and generally pursue smaller gulls and terns, and compel them to drop or disgorge their prey. Only one species of true skua (*Megalestris skua*) enters the North American fauna and this is rare. With the related jægers, it is remarkable in the possession of a cered bill and a pair of elongated middle tail feathers, though the latter character is less pronounced than in the jægers. It is a large, robust bird, especially when adult, and is remarkable for its vigorous and varied flight and piratical habits. It breeds in the far north, making a flimsy nest on the ground and lays 2 or 3 deeply blotched eggs This species is more common on northern European coasts and three species of jægers are also common to the two continents and range even much more widely. They are the pomarine jæger (*Stercorarius pomarinus*), 21 inches long, dusky and mottled above, brownish-white below; the Arctic or parasitic jæger (*S. parasiticus*), about 20 inches long, occurring under two different plumages, one entirely sooty, the other with white under parts, and *S. longicaudus,* the longtailed jæger, about 14 inches long, upper part of head black, upper surface brownish-gray, under surface white. The middle tail-feathers in this species project 10 inches, and the bird is called «marlin-spike» by sailors. Consult: Selous 'Bird Watching' (London, 1900).

Skull, the skeleton of the head; the bony or cartilaginous framework of the head in vertebrates; a superior expansion of the vertebral column. Its shape differs in various animals. In man it is somewhat ovoid, the larger portion being at the top (the dome); and the whole is composed of flat and irregular bones — eight bones enclosing the cranial cavity and 14 forming the face. The skull rests and nods upon the first vertebra (atlas). It also rests upon a tooth-like process (odontoid process) of the axis, or second bone of the spinal column, which projects upward through the atlas and forms a pivot or swivel, upon which the head rotates, the atlas also turning with it. The preponderance of the cranial portion of the skull over the face portion is most pronounced in man, because of the higher development of the brain. The cranial portion (cranium) is composed of the occipital, frontal, sphenoid, and ethmoid bones, and the two parietal and temporal bones. These bones are united either by sutures (dovetail joints) or beveled edges. The upper bones of the skull of a baby do not usually unite until months after birth, their condition allowing the brain to grow. The dovetail joints later in life fasten these bones together very firmly. This jointure, together with the strong buttresses in the temporal bones and the tie-beam function of the sphenoid, adapts an adult for carrying considerable weight upon the head without injury. If the upper cranial bones of a baby are united at birth or soon after, the child is usually an imbecile or idiot. The tissue of the flat bones of the skull is arranged in layers; the outer one was likened by the ancients to wood, the middle one to leather, and the inner one to glass. The cranial cavity contains the brain and proximal portions of the cranial nerves. See BRAIN; CRANIAL NERVES.

The principal opening of the skull is the foramen magnum for the transmission of the commencement of the spinal cord, the spinal accessory nerves, and the vertebral arteries. Other openings to the orbits, the interior of the temporal bones, etc., transmit the optic, auditory, and other nerves, as well as blood-vessels, and are so arranged that these nerves and vessels are not easily injured.

The bones of the face are the inferior maxillary, and the vomer, the two nasal, superior maxillary, lacrimal, malar, palate, and inferior turbinated. The inferior maxillary, or lower jaw, forms the chin (a distinctive feature of man), moves in mastication and speech, and is

Digitized by Google

joined to the temporal bone by a ball-and-socket joint. The lacrimal bones are small bones forming part of the inner wall of the orbit, one of the principal openings in the face The malar bones are the cheek-bones. The palate-bones assist in the formation of the outer wall of the nose, the roof of the mouth, and the floor of the orbit. The nasal bones form the bridge of the nose; the vomer forms part of the septum of the nose, separating one nasal cavity from the other. The superior maxillary bones (maxilla, the jawbone) form the upper jaw and a large part of the roof of the mouth, the outer wall of the nasal fossæ, and the floor of the orbit. The inferior turbinated bones extend horizontally along the outer wall of the nasal fossæ. The principal external openings of the skull in the face portion are the orbits, the mouth, and the nasal opening; in the cranial portion, the foramen magnum, and the external auditory canal. See ANATOMY; HEAD; MEDULLA OBLONGATA; SPINE AND SPINAL CORD.

Skull-cap, any one of the labiate genus *Scutellaria,* bitter herbs, having square stems, simple, opposite leaves, and blue or violet flowers, in terminal or axillary racemes. The flowers have exserted ascending corollas, curved, with arched upper, and spreading lower lips. The calyx is campanulate, gibbous, and two-lipped, the upper one with a crested protuberance on top, that causes it, when in fruit, to very much resemble an ancient helmet, with the visor down, and to which the common name obviously refers. This skull-cap covers four nutlets, which are ejected by the upspringing of the pedicel, if bent down by an animal, for instance; and it is said that the visor directs these seeds on to the animal's coat, when they escape from between the lips. However, the lid soon falls off. Several species are cultivated, as the Siberian, *S. baicalensis,* producing during the summer many dark-blue flowers an inch long; and the whole genus is one of the handsomest of the many American mints. The madwort (*S. lateriflora*) is a common slender herb in wet places, with ovate leaves and violet flowers, and was at one time supposed to be a cure for hydrophobia.

Skunk, a representative of several genera of small carnivorous mammals of the weasel family (*Mustelidæ*), of which they, with the badgers, constitute the sub-family *Melinæ,* characterized by having elongated toes with blunt nonretractile claws and no webs. The true skunks are notorious for the large size of the anal glands, and the offensive odor of their secretion. They are always black, marked by variously arranged and sharply contrasting bands and spots of white, and are exclusively American. Three genera are recognized. *Mephitis* includes the common typical skunks of relatively large size with the skull arched above and the face short and truncated. There are 34 teeth with the following formula: i. $\frac{3}{3}$, c. $\frac{1}{1}$, p. $\frac{3}{3}$, m. $\frac{1}{2}$. The body is elongated, and usually much arched; the tail long and thickly covered with long, fine hair; the head small, with thick, blunt snout; the legs short, and the paws comparatively large, with five incompletely divided toes. The power, characteristic in some degree of all the *Mustelidæ* of forcibly discharging the fetid secretion of the anal glands is enormously developed. Ten species have been differentiated in North America ranging throughout the continent, but as they differ little in habit, the common skunk (*M. mephitica*) may be taken as typical of the whole genus. This species, as now limited, is confined to the Eastern States, where it is exceedingly common, particularly in the farming districts of New England. It is about the size of a cat and has fur of a glossy black; on the forehead is a patch of white diverging into two lines which extend the whole length of the back and meet again in the beautiful bushy tail. The tip of the tail is also white, and, as it is usually carried erect, the white is regarded by some naturalists as a «warning color.» Thus Belt writes: «The skunk goes leisurely along, holding up his white tail as a danger flag for none to come within range of its nauseous artillery.» It chiefly frequents high-lying, bushy, or rocky districts and the banks of the rivers, usually remaining concealed in its burrow by day, but emerging at dusk in search of the worms, insects, birds, small mammals, and their young and the eggs of ground birds which form its food. At times it becomes quite destructive to poultry, but offsets this by clearing out houses of rats and mice.

Its movements are slow and leisurely. It never attempts to run away if pursued, for, feeble and defenseless as it looks, it is most efficiently protected by the possession of a nauseous fluid, the discharge of which neither man nor beast will wittingly provoke. When attacked the skunk turns its back, erects its tail, and, by means of a muscular contraction, ejects the contents of its anal pouches from the protruding orifices of a pair of ducts with a force that carries them to a distance of 10 or 15 feet. So penetrating is the evil odor of this fluid that it may sometimes be perceptible a mile off, and so persistent is it that clothes defiled by it can rarely be entirely purified. The fluid will excite severe inflammation of the eyes, and cases are cited of Indians who have thus lost their eyesight. Few carnivorous animals care to attack the skunk, and this immunity results in a life of comparative ease, with a loss of agility and an assumption of corpulency in striking contrast to the slender and active weasels. The skunk is hunted for its fur, which is in considerable demand. During the fall and winter skunk-hunting is an industry of considerable importance in Maine, and that State alone yields annually between 100,000 and 200,000 skins, most of which are shipped to Philadelphia where they are prepared for shipment to Paris, chiefly in the guise of «monkey» skins. Recently skunk-farming has been entered into as a regular business in some parts of New England. Skunks are trapped, killed with clubs or by means of dogs especially trained to pounce upon them before the fluid can be discharged. Skins are deodorized by heat and smoke. Their bodies also yield an oil used in making liniments, and the flesh is sometimes eaten and reported as being very sweet and tender.

Skunks usually raise from 6 to 10 young in a season. If taken young they are easily tamed and make pretty pets, for they are cleanly in habit and rarely emit their offensive secretion save when provoked. The families remain together for about a year, and during the coldest months of winter they all hibernate together in the same burrow. It seems to be fully estab-

Digitized by Google

nished that the skunk is affected with a disease similar to canine rabies and that fatal cases of hydrophobia have resulted from the bite of even apparently healthy animals.

The skunks of the genus *Spilogale* are smaller and differ in the depressed skull, unarched above. The white stripes are more numerous and often incomplete. The 12 described species are mostly confined to the western and southern portions of the United States and to Mexico. One species, the little striped skunk (S. *ringens*), is abundant from Florida to Virginia and westward to Mississippi. It is about 14 inches long, with a broad white patch on the forehead, four white parallel dorsal stripes much broken behind, and a white tip to the tail. The third genus (*Conepatus*) has only 32 teeth, one of the upper premolars being absent, and differs in other respects from the foregoing. *C. mapacito* is the typical skunk of South and Central America and this or a closely related species extends through Mexico into Texas. Except that it does not hibernate its habits are essentially like those described for the common skunk.

Consult: Coues, 'Fur-bearing Animals' (Washington 1877); Merriam, 'North American Fauna, No. 4' (Washington 1890); Ingersoll, 'Wild Neighbors' (New York 1897).

Skunk-cabbage, a common plant (*Spathyema fœtida*) of the order of *Araceæ*, found in colonies in bogs in eastern North America, and also in Asia. It begins to bloom in winter and the spathes, which are pushed through the mud thus early, are cowl-like, having a twisted point overhanging the orifice; they are fleshy, curiously mottled with purples, greens and yellows, and protect a round spadix in which 4-merous perfect flowers are imbedded. These are purplish and are the first pollen-bearers to be visited by bees.

Skupsh'tina, skûpsh'tĭ-nạ, the national assembly of the Servians. See SERVIA.

Sky. See ASTRONOMY; ATMOSPHERE; CLOUDS.

Sky-rocket. See PROJECTILES.

Skye, skī, Scotland, the largest island of the Hebrides, off the western coast of Inverness, covers an area of 535 square miles. Its scenery is celebrated. The deeply indented coast is lined by bold and lofty cliffs or basaltic pillars; the interior is mountainous moorland, interspersed with lochs. The Cuchullin Hills at the south form the highest point of land, and toward the east, Blavin reaches an elevation of 3,042 feet. The Red Hills (2,403 feet) rise toward the northeast. The acreage is very small and there are few trees. The climate is variable and moist. Much of the land consists of pasturage. Sheep and cattle are raised, and fishing is a chief occupation. Portree, the chief town on the east coast, has a good harbor. Pop. about 17,000.

Skye Terrier. See TERRIER.

Skylark, a European lark (*Alauda arvensis*), one of the most popular European cage birds from the variety and power, rather than the quality, of its song, and the ease with which its health is preserved in captivity. It inhabits all of Europe, many migrating south in winter. The adult male is about seven inches long; crown dark brown with paled edges, forming a crest, upper parts brown, each feather with a spot of darker hue; throat and upper part of breast grayish-brown, spotted with dark brown, abdomen yellowish-white, deepening into pale brown on the flanks; tail feathers various shades of brown. The female is a little smaller than the male.

The bird is famous wherever English is spoken and English poetry is read, for its flight-song, begun in early spring, and continued all through the summer. When it first rises from the earth, its notes are feeble and interrupted; as it ascends, however, they gradually swell to their full tone, and long after the bird has reached a height where it is lost to the eye, it still continues to charm the ear with its melody. It mounts almost perpendicularly, and by successive springs, and descends in an oblique direction, still chanting its rippling music.

The female forms her nest on the ground within some depression, which serves to hide and shelter it — often in grainfields. She lays four or five dirty white eggs, blotched and spotted with brown; and she generally produces two broods in a year. These prolific birds live on seeds and insects; they are most abundant in the more open and highest cultivated situations abounding in grain. In winter they assemble in vast flocks, grow very fat, and are taken in great numbers for the table, especially in the Mediterranean region.

Skyros, skī'rŏs, Greece, an island of the Ægean Archipelago, 25 miles east of Eubœa. It is 18 miles long by 7 wide. It consists of two parts, connected by a mountainous isthmus. To one part belongs the mountain Kochilas; the other, or northern division, is lower and covered by fertile plains and slopes. The higher grounds are densely wooded. The products are wheat, wine, oil, and oranges. The raising of live stock — especially goats — is a considerable industry; also a species of small horses. A Greek monastery occupies the greater part of the modern Skyros. Theseus, the hero of Athens, died here, and his bones were carried to that town when under Kimon the Athenians took Skyros.

Slafter, Edmund Farwell, American historian: b. Norwich, Vt., 30 May 1816. He was graduated from Dartmouth in 1840, took orders in the Episcopal Church and held rectorates in Massachusetts prior to 1877. He is the author of 'Sir William Alexander and American Colonization' (1873); 'Voyages of the Northmen to America' (1877); 'John Checkley, or the Evolution of Religious Tolerance in Massachusetts Bay' (1897); and other historical books and monographs.

Slag. See METALLURGY; SMELTING.

Slander, a false and malicious oral defamation which tends to injure or disgrace the person so defamed. The chief difference between slander and libel is that the latter refers to malicious defamation expressed by writing, printing, or illustration. The law draws a wide distinction between the two actions. Words are held to be actionable, whether or not special damages are shown to have accrued from the defamation, if they impute a criminal offense against the law; the having of a contagious disease; or if they are such as would affect one injuriously in his profession or trade. If the words are not so actionable, yet false and malicious, the party aggrieved cannot recover unless able to prove that he has sustained some certain actual loss

Digitized by Google

therefrom. If the party charged with slander prove that the words complained of are true, no action will lie for defamation, whether or not said words are actionable, for in that event the law holds them to be justifiable. Charging one with having committed perjury has always been regarded as being actionable, and in many jurisdictions it is so provided by statute. Words which in themselves are not actionable may in reality be so through an allusion to some collateral facts, or through being used and understood in some particular sense, and in such cases, when the offensive sense is proven, it is held to be slanderous. Words in themselves slanderous may be accompanied by explanations which deprive them of that character. There are certain kinds of communications which are regarded as privileged, and are therefore not actionable, as, for example, the statement made in a judicial proceeding, or where one communicates to another a circumstance which he has the right to know relating to a matter of mutual interest; however, this privilege will not justify slander if malice be shown.

Slate, a clay rock (argillutyte) which has been subjected to compression during mountain-making processes in the earth's crust, and which as a result splits readily into thin sheets or cleavage laminæ in a direction at right angles to the direction of compression. According to Sorby, cleavage is produced in such rocks by the rearrangement during compression of the plastic particles comprising the original rock mass, in such a manner that their longer axes come to lie perpendicular to the direction of compression, and that planes of easy fracture were thus produced parallel to the long axes of the particles. This was illustrated by Sorby, with a cube of clay through which mica scales or scales of oxide of iron were sprinkled, which was then subjected to powerful compression and drying. A perfect cleavage at right angles to the line of pressure was produced, and microscopic examination showed that the mica scales lay in the direction of cleavage. Tyndall found by experiment that cleavage is more perfect in proportion in which the cleaved material is free from foreign particles, such as mica scales, and he considered that cleavage was produced in homogeneous rocks (except the vitreous) by the compression and flattening of the minute discrete granules or particles of which all such matter consists. The structure is changed by the compression from granulous to scaly. Enormous vertical swelling of the rock masses results through such lateral compression, and this swelling is an important factor in the formation of mountains.

Ordinarily cleavage exists in rocks in a potential manner only — the rock is cleavable in a certain direction, but no actual separation takes place. This, however, is rapidly developed when the rock mass is exposed to atmospheric influences. Slates are quarried in solid blocks, and split up in thin sheets, usually by hammer and chisel after quarrying. The important slate producing horizons of eastern United States are the Cambric and Ordovicic beds of the Taconic range of eastern New York and its extension in Vermont, and the corresponding formations of Pennsylvania and other regions in the northern Appalachians. In composition slates vary greatly, especially in the proportion of silica. An analysis of common roofing-slate gave the following: Silica, 48; alumina, 25.50; oxide of iron, 11.30; potash, 4.70; magnesia, 1.60; carbon, .30; water, 7.60. Since slate is in reality a structural term, denoting the property of easy splitting so characteristic of roofing slates, rocks of almost any composition may be indexed under this term, provided they show the characteristic slaty cleavage. Thus it has become customary to speak of anthracite slate, in which a considerable percentage of carbonaceous material is present; whet slates, — clay slates, with a large percentage of silica, often nearly pure silica (Novaculytes); talc slates and chlorite slates, where those minerals are prominent; gray-wacke slates, more or less arenaceous and micaceous slates. Roofing slates, however, are the typical slates, and the ones in which the slaty cleavage is best developed. The most important localities for these in the United States are Vermont and Pennsylvania.

The slate belt of Pennsylvania first appears in the eastern corner of York County and «then sweeps around in a gradually narrowing curve to the Susquehanna River.» It reappears on the eastern bank of the Susquehanna in Lancaster County, but can be traced for a comparatively short distance from the River. While this belt is quite limited in extent, being but six miles long and less than one mile in width, it is nevertheless producing a very high grade product. It is from this belt that the well-known «Peach Bottom Slate» has come. It has remarkable strength and durability, exceedingly fine in grain and texture, and the very desirable quality of retaining its original color even after continuous exposure for many years. It lacks the high degree of fissility, however, that characterizes other localities. Microscopic study of thin section from this belt shows, according to Merrill, that the slate is not fragmental in character, but on the other hand is a «highly carbonaceous, crystalline schist.» This is attributed to the high degree of metamorphism to which the belt has been subjected. Bangor and West Bangor are the centres of greatest activity. The belt continues for a short distance into Maryland where a few smaller centres of production are located. Maine follows Vermont with a valuation of $202,325 for 1901. There are five areas of note in the state. One of the two larger belts extends from Franklin County northeastward to Aroostook County, thence northward into New Brunswick. The second passes from the western boundary of Somerset County, in an easterly direction to Houlton, Aroostook County. «Of the three smaller areas, one is on the Kennebec River, south of Skowhegan, and the two others in Washington County, about Baskahegan Lake and near Princeton.» Only portions of the two larger areas produce slate of a medium or high grade.

Colorado, Dakota, Massachusetts, Michigan, Minnesota, New Hampshire, Tennessee, South Carolina, Texas and Virginia are known to contain slate terranes of more or less importance. Very little effort, however, has been put forth to develop the slate industry in these respective States.

An inspection of the most recent statistics reveals the fact that there are now some fourteen productive States in the Union. Pennsylvania takes the lead, with annual valuation

Digitized by Google

of $2,984,264, for the production of 1901. This was increased in 1902 to $3,547,322. Vermont takes second place with a valuation of $1,162,191 for 1901, and $1,464,913 for 1902. The valuation of the slate production of the following States exceeded $70,000; these are Maine, Virginia, New York, and Maryland. Arkansas, California, Georgia, and New Jersey also yield small amounts, but their total valuation for 1901 amounted to only $71,500. In 1901 the valuation of the total production of the United States was $4,787,525. In 1902 it reached $5,696,051, thus showing a gain of nearly one million dollars. This was largely due to the increased output in Pennsylvania and Vermont. The latest addition to the list of producers is the State of Arkansas.

Export trade in roofing-slate reached its highest mark in 1898 with a valuation of $1,370,075. Great Britain was the chief importer of our product at this date. From the above date, however, our exports materially decreased. This was in the main due to the settlement of strikes in the Welsh quarries and the consequent development of the slate industry in Wales. British Australia and Denmark were also importers of the American product.

One of the most remarkable slate belts of this country lies in eastern New York and western Vermont, between the Taconic range on the east and Lake Champlain and the Hudson on the west, and chiefly between the Hoosic River on the south and the towns of Benson and Hubbardton, in Vermont, on the North. It attains a maximum length of 68 miles and an average width of about 7 miles. The great producing centres lie in Washington County, New York, and Rutland, Vermont.

The slates in this field are green of various shades, purple, variegated, that is, mixed green and purple, red and also black. See SHALE; SEDIMENTARY ROCKS.

A. W. GRABAU,
Columbia University.

Sla'ter, John Fox, American philanthropist: b. Slatersville, R. I., 4 March 1815; d. Norwich, Conn., 7 May 1884. He inherited from his uncle, Samuel Slater (q.v.), the cotton spinning enterprises which he had founded, and so managed them as to acquire a large fortune. He contributed generously to the establishment and maintenance of the Norwich Free Academy and other similar institutions, but is best known for his gift of $1,000,000, forming the «Slater Fund,» for the education of freedmen in the South. For this benefice Congress voted him a resolution of thanks and a medal. See SLATER FUND.

Slater, Samuel, American manufacturer: b. Belper, Derbyshire, England, 9 June 1768; d. Webster, Mass., 21 April 1835. He had worked under Arkwright and Strutt in the cotton factories in England and had helped in devising some of the machinery used there, and hearing that a bounty had been offered in the United States for the introduction of the Arkwright patents, he came to this country determined to win it. As the English law forbade the exportation of drawings or models of the English machinery, Slater had to depend entirely on his memory for the mechanical details. He succeeded in constructing at Pawtucket, R. I., the first cotton mill in the United States. He afterward established mills at Oxford (now Webster), and in a locality now known as Slatersville, where the business is still carried on by his descendants.

Slater Fund, the gift of John Fox Slater, of Norwich, Conn., to the cause of educating the negroes of the South, was originally the sum of $1,000,000. The gift was made in 1882, to a board of trustees, who were to hold the principal and expend the interest in promoting institutions already established on a permanent basis. In acknowledgment of this philanthropy Congress voted the donor thanks and a medal. By the terms of the gift neither principal nor income is to be expended on buildings or grounds. The fund is expended principally in helping students of, and preparing teachers for, the manual training schools, agricultural and mechanical colleges and technological institutions. The board consists of D. C. Gilman of Johns Hopkins University, as president; Chief Justice Fuller, as vice-president; Morris K. Jesup, as treasurer; J. L. M. Curry, as secretary and general manager; and Bishops Potter and Galloway, and Messrs. William E. Dodge, William A. Slater, John A. Stewart, Alexander E. Orr, and William H. Baldwin, Jr., and Cleveland H. Dodge. The fund is a potential agency in working out the problem of the education of the negro, and over $500,000 has already been expended. By the extraordinary fidelity and financial ability of the treasurer, the fund, while keeping up annual appropriations, has increased to $1,500,000. Schools established by States, denominations, and individuals are helped by annual donations. Among the most prominent are the Hampton Normal and Industrial, the Spelman, the Tuskegee, and schools at Orangeburg, S. C.; Tongaloo, Miss.; Marshall, Texas; Raleigh, N. C.; New Orleans, the Meharry Medical College at Nashville, etc.

Slaughter-house. See ABATTOIR.

Slaughter House Cases arose out of laws passed in 1869 by the legislature of the State of Louisiana in an act intended to protect the public health in the city of New Orleans and to that end incorporating The Crescent City Live Stock Landing & Slaughter-house Company. The act gives to this company the sole right «to land, keep, or slaughter any cattle, beeves, sheep, swine, or other animals . . . within the city of New Orleans, or at any point or place . . .» on the east or west banks of the Mississippi River, opposite the corporate limits of the city. Included with this privilege, granted to this company and forbidden to all other persons, was the right to establish wharves for the landing of live stock and to levy wharfage on the stock landed at so much per head. This act was bitterly opposed by the butchers and cattle dealers, and after it went into effect an action was brought in the district court and an injunction obtained on the ground that the law was unconstitutional; when the case was tried the court sustained the injunction and made it perpetual, on the ground that it was in opposition to the 14th Amendment of the United States Constitution (q.v.), and to the first and second sections of the State «Bill of Rights.» In delivering his opinion the judge (Collens) said as follows: «This law (1) prevents any freedom whatever; (2) walls up many miles of the shores of the river on both sides against an important branch of commerce; (3) vests

Digitized by Google

as it were a private company with an ownership in one of the greatest ports of entry in the United States; (4) gives this company alone the authority to 'establish wharves' for vessels bringing live stock into the port of New Orleans; (5) yields it the 'exclusive' right of having one or more stock landings, with the 'exclusive' privilege of having landed at its wharves and landing places all animals intended for sale or slaughter in the parishes of Orleans and Jefferson; (6) authorizes it to determine at what points or places wharves, stock-landings, etc., may be erected; (7) grants it the power of levying wharfage not simply on the vessels, according to tonnage and time, but a round sum on the vessels, and a duty of 10 cents per head on large, and 5 cents per head on small beasts landed in this port; and (8) all this is made effective by penal clauses imposing fines, etc." The judge declared that this was not only against the clauses named, but, surpassing police regulation, was also "a bold and well contrived regulation of commerce, compelling the coveted trade to flow into the channel, and leave the tribute in the coffers of this private monopoly," and as such was in violation with both the provision in the Federal Constitution giving Congress the sole power to regulate commerce, and the act of Congress under which the State of Louisiana was admitted into the Union.

This decision, with others, some varying, which had been given in different district courts, were the next year, 1870, carried into the Supreme Court of the State, and there the case was determined in favor of the defendant corporation, and all persons enjoined from interfering with the privileges granted to it under its charter. The opponents of the company then took the case into the United States circuit court; asking for a perpetual restraining injunction against it. This was granted on the sole ground that the act incorporating the company was in violation of the 14th Amendment of the Federal Constitution, the court disclaiming jurisdiction over any other of the issues raised. A writ of error was asked for and obtained, and on it the case was carried to the United States Supreme Court. Here, after being three times argued, a decision was delivered in 1873, recognizing the validity of the act and permitting the exercise of the powers conferred by it. The decision of the court on the various issues involved gave the case its great importance. It had been contended, in the first place, that the act was invalid because it created a monopoly, conferring privileges on a few persons to the exclusion of all others, and depriving a numerous class of citizens of the right to follow their usual employment. On this point the court decided that the act was within the police power of the legislature — "a power incapable of any very exact definition or limitation." From the decision upon this point a minority composed of the chief justice and two associate justices dissented. The objection had been urged by the complainants that the act was a violation (1) of the 13th Amendment of the Federal Constitution, by creating a kind of involuntary servitude; and (2) of the 14th Amendment, because it abridged the privileges and immunities of citizens of the United States, deprived the plaintiffs of their property without due process of law, and denied them equal protection under the law. The court held that the term "servitude" in the 13th Amendment means personal servitude and that the purpose of the amendment was to guard against a continuance of slavery in any form, and that the amendment had not been violated by the act under discussion. As regarded the 14th Amendment the court perceived and established the difference between a citizen of the United States and a citizen of a State; it defined the rights and privileges of these two classes of citizens and held that only a citizen of the United States was placed under the protection of the Constitution by the clause in the 14th Amendment. The court further held that no other clause of the Amendment was violated, the act of the legislature of Louisiana not being a deprivation of property, nor a denial of the equal protection of the laws, within the meaning of the Amendment.

The minority of the court held (1) that the act of the legislature was of itself a step beyond the police powers of the State, and therefore was void; (2) that the act was also void under the 14th Amendment since it is in the meaning of that amendment that all acts of a State legislature shall respect the equality of rights of its citizens to follow the ordinary pursuits of life which equality of rights, the minority held, had been contravened.

The decisions of this case are considered extremely important because they not only discuss the police powers of the States, but because of the interpretations of the clauses in the Federal Constitution brought into issue. The case is reported in 16 Wall., 36, Supreme Court reports.

Slave Coast, Africa, a name formerly and still sometimes applied to a part of the coast of the Gulf of Guinea, from the mouth of the Niger westward to the river Volta. It is the coast of Togo, Dahomey and part of Nigeria, belonging, respectively, to Germany, France, and England. It received its name from the fact that its ports were the chief centres for the exportation of slaves.

Slave Lake, Great. See Great Slave Lake.

Slave Lake, Little, Canada, a lake in Athabasca Territory, about 270 miles southwest of Lake Athabasca. It is drained by the Lesser Slave River into the Athabasca or Elk River. It is about 60 miles long, and its greatest breadth is about 12 miles. The surface of the lake is 1,890 feet above sea-level; it has been known to keep free from ice until Christmas.

Slavery, a system by which certain persons are kept as the property of others. The system is one of great antiquity and was early practised among the Hebrews. The slaves of the ancient Romans were either captives or debtors that were unable to pay. In Rome the slave had originally no rights at all. He could be put to death for the smallest misdemeanor. Slaves were exceedingly numerous, and latterly almost monopolized all the various handicrafts and occupations, those of the clerk, the doctor, and the literary man included. In the time of Augustus a single person is said to have left at his death over 4,000 slaves. Hosts of slaves were employed in the gladiatorial exhibitions. Slave revolts occurred in 134 and 102 B.C. in Sicily, and a revolt in Italy led by the gladiator Spartacus in 73 B.C. was not put down without

Digitized by Google

considerable difficulty. Slaves, however, were often set at liberty, and these freedmen were a well-known class at Rome. But it was not till the time of the empire that any great change took place in the condition of the slaves. Augustus granted the slave a legal status, and Antoninus took away from the masters the power of life and death over their slaves.

The early Christian Church did nothing to suppress slavery, and slavery and the slave-trade continued to exist for 1,000 years in the Christian nations of Europe that rose on the ruins of the Roman empire. It was not till the 13th century that the severity of slavery began to decline in Europe. The Koran expressly permits the Moslems to acquire slaves by conquest, but this method of acquiring slaves was not resorted to until the Crusades. Previous to the Crusades they kept negro slaves imported from Africa. Latterly the Mohammedans began to obtain white slaves not only by war but also by purchase, Rome being the centre of the trade. The Mohammedans of the Barbary states also obtained white slaves by piracy in the Mediterranean.

After slavery had become all but extinct in Europe, it had a new birth in the American colonies of European origin. The Portuguese were the first to hunt negroes in the interior of Africa for use as slaves in the colonies. The first shipment of negroes to the New World took place in 1503, when the Portuguese landed some in Santo Domingo. From that time to the 19th century a traffic in negroes across the Atlantic was carried on by all the Christian colonial powers. See United States, Slavery in the.

Slavery in the United States. See United States, Slavery in the.

Slavonia, slă-vō'nĭ-ạ, a territory of Austria-Hungary which, with Croatia, constitutes the kingdom of Croatia and Slavonia and forms part of the possessions of the Hungarian crown. It is bounded on the northeast by Hungary, on the south by Bosnia and part of Servia and on the west by Croatia, and has an area of 3,640 square miles, exclusive of that portion of the military frontier lying between Slavonia and Croatia, which may be regarded as falling within its limits. A branch of the Carmolan Alps, entering Slavonia from Croatia on the west, traverses it throughout its whole length, forming the watershed between the Drave on the north and the Save to the south. The forests are very rich and cover the upper mountain sides on whose lower slopes cultivation is actively carried on. The valleys are extremely fertile; but there are large swamps created by the frequent inundations of the river rendering the climate in parts extremely unhealthy. Agriculture is by far the most important occupation, the principal products being grain, fruit, flax, hemp and wine, and the leading exports, grain, wine, fruit, cattle, lumber, and the celebrated *Sliwowitz* brandy, distilled from plums. The inhabitants are chiefly Serbs and profess for the greater part the Roman Catholic and the Greek Orthodox faith. The chief town is Eszek. With Croatia it has a national Landtag or Diet and sends representatives to the Hungarian parliament. The population of Croatia and Slavonia is about 2,500,000.

As part of Illyricum, Slavonia was acquired by the Romans in the reign of Augustus and was incorporated with the province of Pannonia. From the Byzantines it was wrested in the 5th and 6th centuries by the invading Slavic tribes, from which time dates its close union with the country to the west which came to be known as Croatia. The united state was ruled by princes of the Hungarian royal house till the early part of the 16th century, when Slavonia was overrun by the Turks. They were driven out at the end of the following century and the territory was organized on a military basis for the defense of the Austrian frontier. Part of Slavonia was placed under civil administration in 1745, but the Military Frontier was not done away with till 1873.

Slavs, slạvz, the general designation for a group of peoples inhabiting eastern and central Europe and forming one of the most important branches of the Indo-European family of nations. The name is derived from the native term *Slovenia*, the origin of which is obscure, some connecting it with *slovo*, word, speech, and others with *slava*, fame. In support of the former etymology is the fact that the Slavic term for foreigner is *nientsy*, dumb, as marking the differentiation between those whose speech was intelligible to the Slav ear, that is, the Slavs themselves, and those who made use of an incomprehensible tongue. The connection between Slav and slave, though supported by the analogy of *servus* and Serb, is nevertheless merely fanciful. The Slavic group comprises the following nationalities: Russians therein included the Great Russians, the Little Russians, and the White Russians, Bulgarians, Serbo-Croatians, Slovenians, Czechs, comprising the Bohemians, the Moravians and the Slovaks, Wends or Sorbs, consisting of the inhabitants of Upper and Lower Lusatia, and Poles with the allied Corsubians. The Polabians, a Slavic people formerly living on the Elbe, have been extinct since the middle of the 18th century. The early history of the Slavs is veiled in obscurity, and only an approximate idea as to their original home is to be obtained. In Pliny and Tacitus the name Venedæ (whence the modern Wenden) appears as the designation of a group of non-Germanic tribes living to the northeast of the Carpathian Mountains and extending to the shores of the Baltic and the lake country of the Finns. Ptolemy in the 2d century of our era gives a description of the peoples residing between the Vistula and the Don which would undoubtedly tend to connect a part at least of these tribes with the Slav family. Roughly the home of the Slavs in the first centuries after Christ may be given as extending from the Vistula and the Carpathians northeastward to the headwaters of the Volga and along that stream to its junction with the Oka, and southeastward to the Bug and Dnieper, comprising thus the southwestern third of the present Russian empire. South and southeast of the Baltic, however, were the Lithuanians, a non-Slavic people, though nearest to the Slavs of all Indo-European stocks. In the 6th century Procopius and Jardanes speak of two great Slavic nations, the Sclaveni and the Antes as established on the left bank of the Danube and to the north. From this it would seem that in the 3d or 4th century the Slav peoples began to migrate from their homes southward, and westward, under pressure probably of the

Digitized by Google

Baltic tribes to the north. In the 5th century they took possession of the country between the Vistula and the Elbe, left unoccupied by the southward migration of the Germanic Burgundians, Goths, Suevi, etc. About the same time Slav tribes entered Bohemia and Moravia and others advancing from behind the Carpathians made themselves masters of western Hungary, whence they passed into Syria, Carinthia and Carinola. At the beginning of the 7th century the Slavs on the Danube crossed into Mœsia and overran Thracia and Macedonia as well, and at the same time the Croats and the Serbs made their homes in the ancient Illyricum and Dalmatia. A second great wave of Slav migration starting from the original home north of the Carpathians, spread east and north, pushing the Finns before them. Under Scandinavian rulers these tribes became the nucleus of the Russian nation. Of this wide area of conquest they have lost in the process of time the regions of the Oder and the Elbe, Upper Austria and part of Carinthia and Styria, of all of which they were deprived by the Germans; large parts of Transylvania and Hungary which fell to Rumanians and Magyars; and parts of the regions south of the Danube which have passed to the Greeks and the Turks. The number of Slavs in Europe is estimated at about 120,000,000, of whom the great bulk, more than 85,000,000, reside within the limits of the Russian empire (Russians and Poles), the other nationalities in order of numerical strength being the Czechs-Slovaks and the Croatians in Austria-Hungary, the Bulgarians, under the suzerainty of Turkey, the Serbians, independent, the Bosnians and Herzegovinians, and the Montenegrins. (See the articles on the various countries mentioned.)

The ancient Slavs were almost exclusively an agricultural people, averse to war, and living in complete tribal independence under a fully developed patriarchal system which at a later time became blended with a communal form of government. They were the latest of all the European peoples to enter the sphere of modern civilization, their religion and their literature being, as compared with the other nations, of recent date. The eastern branch of the Slavs received its civilization and religion from Byzantium, the western Slavs from Rome. Christianity made rapid headway among them in spite of the fact that they seem to have possessed a well developed nature-cult about which, however, we possess no definite information. Our materials are limited to the names of various deities worshipped among the northern Slavs, while as to the mythology of the southern branches of the race even such data is wanting. Among the gods of the Russian Slavs were Pernu, identified by some with Thor the northern God of Thunder, Dazbog (the Day God), Wolos, Stribog and others. Svintovint or Sviatovit was the great god of the Baltic Slavs (Rügen), and some who maintain that along with their idol-worship the Slavs possessed a belief in a supreme God, would assign to Svintovint, that role. Grimm erects Svintovint, Pernu and a god named Radegast into a trinity with functions corresponding to the classic Jupiter, Vulcan and Mercury respectively. Other deities worshipped by the Slavs were Prove, the god of justice; Rugevit, of war; Triglaw; Lado and Lada, divinities of order and love; Dievana (Diana), goddess of the woods, and Prija, the Scandinavian Freya. Among the Silesian Slavs the principles of light and darkness were typified by the Bielobog and the Czernobog, the White God and the Black God. The mythology of the Slavs was rich in deities of a lower order, in nymphs, naiads and mountain sprites, in goddesses of birth and fate, divinities of the hearth and the field, in evil demons and vampires. The forms of the Slavonic deities recall to mind those of India. Svintovint was represented as four-headed. Pernu, as four-faced, etc. There is some testimony to a belief entertained by some of the Slavs in the immortality of the soul and a resurrection beyond the grave. Their principal celebrations were the *kobiada*, a feast held at the beginning of the year, when an interchange of presents was customary; the *kupalo*, a feast that took place in honor of the sun at the time of the summer solstice; and the *trisna*, celebrated in honor of the dead. The functions of priest and ruler were combined in the same person.

Languages.— The Slavic tongues have been the subject of much and varied classification. One widely accepted arrangement is as follows: (1 Bulgarian; (2) Serbo-Croatic; (3) Slovenian (2 and 3 sometimes being given as one group); (4) Russian, including Great Russian, Little Russian and White Russian; (5) Czechish with the closely related Slovak; (6) Sorb or Wendish; and (7) Polish, Bulgarian, Serbo-Croatian and Russian have sometimes been classified into a Southeastern Slav group as against a Western group consisting of all the others. To the latter group should be added the extinct Polabian. The oldest of the Slavic tongues is the old Church Slavic or Old Bulgarian, which is still the ritual language of the Greek Orthodox church in Russia, Bulgaria and Servia. The Slavic languages are marked by a richness of vowel sounds and a high degree of inflection, which in the noun gives us seven cases, and in the verb, in spite of a restricted number of tenses, a large number of modal and affective auxiliaries rendering possible the finest distinctions of meaning. The so-called Cyrillian alphabet is made use of in Russian, Bulgarian and Serbian, but the Old Church Slavic makes use also of the Glagolitic alphabet (q.v.). The Polish, Croatian, Czech, Slovenian and Sorb employ the Roman characters.

Slavic Music.— Sentiment, which forms so prominent a trait in the Slav character, renders the members of that race peculiarly subject to the influence of music. In Russia the origins are found in the folk-songs which were greatly influenced by the music of the Church. In the 17th century western influences enter the country and especially the Italian, which lasted well into the 19th century when we have the use of a national school with the appearance of Glinka (q.v.). The prevailing characteristic of Russian music, whether classic or popular, is an all pervading tone of melancholy which has found its fullest expression, perhaps, in the works of Tschaikowsky. Polish music, in many respects resembling the Russian, differs from the latter in a greater vivacity of movement and spirit. The Bohemian is the third important national school of Slavic music and one which in recent years has surpassed the Polish in productivity and held its own with the Russian. For the leading names in Russian music see in addition

Digitized by Google

to those already mentioned, DARGOMYZSHKY; BALAKIREFF; BORODIN; RIMSKY-KORSOKOFF; RUBINSTEIN; ARENSKY; GLAZUNOFF; TANEYEFF. For Poland see KAMIENSKI; ELSNER; DOBRZYNSKI; CHOPIN; MOSZKOWSKI; PADEREWSKI. For Bohemia see SMETANA; DVOŘÁK.

Panslavism.— This name has been given to the agitation carried on by a great party in Russia looking toward the union of the Slavic peoples of Europe under Russian rule. The movement originated about 1830, when the Polish revolution (see POLAND) stirred the national consciousness of Russia to fever heat, and it received increased strength from the second Polish revolution in 1863. Outside of Russia the ideals of Panslavism have been favorably received by the Slavs in Bohemia, Silesia and Croatia-Slavonia where the members of that race feel their national existence threatened by the action of the government, Austrian, Hungarian or German as the case may be. Panslavism was largely responsible for the outbreak of the Russo-Turkish war of 1877-8, when Russia entered the lists as the champion of the Balkan Slavs who suffered from the tyranny of Turkish rule. The Panslavists in Russia have at the same time advocated the abandonment of the policy of Peter the Great which had for its object the reconstruction of the empire on Western models. They assert that the peculiar character of the Russian people renders it imperative that the development of the country proceed on national lines, and attribute most of the political and social evils of the present time to the attempt to force the civilization of Western Europe with its features of democracy and capitalism upon a people like the Russians, whose nature, it is asserted, calls rather for the patriarchal form of government. Within Russia the Panslavists have also borne the name of Slavophiles, which has been especially applied to the literary champions of the movement. See also RUSSIA.

Sleep, a state of rest for both body and mind, during which there is complete or partial abeyance of volition and consciousness, with a relaxed condition of the body and a lessened activity of the vital functions. The muscles do less work in the way of contractions, and there is therefore a diminution in their tonicity; the respirations are less frequent and rhythmical; occasionally there is a long expiratory pause; the output of carbon dioxide is diminished more than the consumption of oxygen; the pulse is less frequent; the secretions are partially suspended, and the eyes are contracted.

Sleep is probably due to the wastes of the body (especially of the nervous and muscular tissues), which affect the blood circulating through the brain, and induce a kind of normal and natural coma by benumbing the cortical cells. All parts of the body require such rest as sleep affords, and share, directly or indirectly, in its benefits, for functional activity without periods of rest results in an undue destruction of the tissues and an excess of poisonous products. The essence of the sleep state is functional rest and nutritive repair. Though the brain is in repose, it builds up complex molecules, just as the secreting glands build up their ferments, etc. Generally, the more both mind and body can be withdrawn from all outside influences the more readily is refreshing sleep obtained. Sometimes pain assists to this end. For example, a man is worried with business cares, and has not slept well of late. One evening he has a severe toothache which demands his entire attention. As the pain is relieved he drops off into a quiet sleep and forgets his troubles in unconsciousness.

The amount of sleep needed by different persons varies with age and condition. The greater part of infancy is generally passed in slumber, which is more profound than that of adults. In middle life about eight hours' sleep a day is necessary, though it is reported of Frederick the Great, and Napoleon that they slept but three or four hours. Old persons frequently require seven or more hours' sleep, though some live healthfully with but six. Occupation, race, sex, climate, and habit have to do with the amount of sleep required. Brain workers, as a class, take less sleep than laborers. Sleep is sounder and longer in cold climates and among northern races. Women usually require more sleep than men. The influence of habit is noticeable when the demand for sleep comes at a definite time, or in the case of those accustomed to sleep amid noisy surroundings, and who cannot readily sleep in a quiet resting-place. Persons of a lively, active temperament sleep less soundly and often take less sleep than those of plethoric habits. Dreamless sleep is the most refreshing. A light sleeper is liable to be disturbed by trifling noises.

The disorders of sleep may be classified as follows: (1) Absence of sleep — insomnia, vigilance; (2) imperfect or partial sleep — dreams, sleep-drunkenness, or somnolentia, night-terrors, and nightmare; (3) perverted or artificial sleep — somnambulism, hypnotism, mesmerism, trance, somnium; (4) excessive or frequent drowsiness and sleep — morbid drowsiness or somnolence, paroxysmal sleep, epileptic sleeping attacks, trance-sleep, carus, cataphora, lethargy — sleeping-sickness of Africa.

The causes of disordered sleep are many, such as brain affections, blood-poisoning, pain, indigestible food, discomfort, produced by undue cold or heat, mental excitement or worry, overfatigue, febrile conditions, sleeping in an uneasy position or with the head too high or too low, too little outdoor exercise, sleeping amidst unaccustomed surroundings. The treatment of disturbed sleep sometimes taxes the art of the physician. Mental repose, bodily comfort, a sufficient degree of warmth, a certain amount of fatigue, combined with perfect quietude, are essential. An evening walk, a cup of hot milk or cocoa, or a weak stimulant just before retiring, massage, counting and verbal repetitions, are aids in producing sleep. Hypnotic medicines should be avoided if possible. Brisk exercise in the open air, every day if possible, to the point of tiring, is a good sleep-producer.

Sleeper. (1) In railroad building, one of the timbers supporting a railway track. When it is longitudinal with the track it is called a stringer or sill; when it is transverse it is called a sleeper or tie. (2) In ship-building the name of a floor timber in a ship's bottom. (3) In carpentry and building, the beams supporting the lower floor of a house, or other structure.

Sleeper-shark. See SHARK.

Sleeping Beauty, The, a fairy tale, probably founded on nature's long sleep in winter.

Digitized by Google

The Earth-goddess falls into a deep sleep, from which she is aroused by the prince, the Sun. We may compare Demeter's search for her lost daughter, Proserpine, in the Greek myth; and the sleep of Brynhild, stung to her sleep by the sleep-thorn. 'The Two Brothers,' found in an Egyptian papyrus of the 19th Dynasty — the time of Seti II. — contains similar incidents. The spindle whose prick causes the long slumber is a counterpart of the arrow that wounds Achilles, the thorn that pricks Sigurd, and the mistletoe fatal to Baldur. In 'Surya Bai' (from 'Old Deccan Days') the mischief is done by the poisoned nail of a demon. In the Greek myth of Orpheus, Eurydice is stung by the serpent. In a Transylvanian variant a maiden spins her golden hair in a cavern, from which she is rescued by a man who undergoes an hour of torture for three nights. The awakening by a kiss corresponds to Sigurd's rousing Brynhild by his magic sword.

Sleeping-sickness, a peculiar disorder, also called sleeping-disease, African lethargy, lethargus, negro lethargy, and nelavan, endemic, especially in western Africa. It is apparently infectious, occurs mainly among negroes, and is said to be very fatal. Recent investigations by the English government and by the Liverpool school of tropical medicine, show that its prevalence has been exaggerated by the natives, that it has been confounded with other prevailing diseases which have some of the same symptoms but are distinct affections. The natives in their dread of this malady are ready to assert that a person having enlarged glands, headache, and a dry skin, and becoming thin and drowsy, has sleeping-sickness. That the disease prevails at times in certain localities, and is generally fatal, is not disputed, though continued and abnormal sleep has not been present in all cases. M. Christy, in July 1902 found an infected area in a strip of coast-line along the shore of Victoria Nyanza over 100 miles in length, and along the margins of all the islands in the British portion of the Victoria Nyanza. Cases of the disease discovered back of this area, were infected, he believes, at the shore. Nearly all the cases of sleeping-sickness that he saw, were in persons who had lived on low swampy ground or near the water-edge, in huts surrounded by banana-plants or forest growth. Compact villages on dry land with but little surrounding foliage were not seriously infected.

Various theories as to the cause of the disease have from time to time been broached. It has been supposed to be due to food-intoxication, like pellagra (q.v.), or caused by one of the many animal parasites common in Africa. Disorders of circulation, mental depression, bad and insufficient food, intestinal and blood parasites are predisposing causes. The recent investigations of Bruce, Castellani, Christy, Dutton Forde, and others show that sleeping-sickness is probably caused by a parasite, a species of trypanosoma, which is transmitted from the sick to the healthy by a variety of the tsetse-fly. This parasite enters the blood and the cerebro-spinal fluid, producing what is called by the recent investigators, human trypanosomiasis, to distinguish it from the trypanosomiasis which affects horses, fish, etc. The species of tsetse-fly in question inhabits the places where sleeping-sickness is prevalent, and Sambon believes that this fly is not only a carrier of trypanosomes, but acts also as an intermediate host; and is troublesome to man at certain seasons.

Autopsy in cases of sleeping-sickness shows chronic meningitis, encephalitis, meningomyelitis, and trypanosomes in the cerebro-spinal fluid and blood. The symptoms may be divided into three stages, one indefinite, one of tremor, and a third stage of intense weakness. "True sleep is not really a symptom of the disease." There is at first a disinclination to work or move about. This is followed by headache, pains, especially in the chest, dulness, slowness in answering questions, mumbling, and a shuffling gait. Then there are tremors of the tongue and hands; glands may be greatly enlarged (but gland-enlargement is common among the natives); the pulse varies from 90 to 130; evening temperature is from 100° to 102° F., with a morning fall of 1°. The patient becomes drowsy, lethargic, and very thin and weak, and takes to bed; the temperature falls, coma appears, and death occurs from convulsions or starvation. The disease usually lasts from four to eight months. Consult 'Encyclopedia Medica' (1903), article on 'Sleeping-Sickness.'

Sleepy Hollow, the valley of the Pocantico Creek, half a mile north of Tarrytown, Westchester County, N. Y. It is best known as the scene of Washington Irving's 'Legend of Sleepy Hollow,' in which he so vividly describes the quiet scenery of the valley and the quaint customs of the old Dutch settlers. The Dutch church, built in 1699, and the old mill conspicuous in the 'Legend' are both standing; and in the newer part of the churchyard cemetery is Washington Irving's grave. Near the mill is the old Philipse Mansion. Above the cemetery rises a knoll, which in 1779 was fortified by the Continentals, but was never attacked.

Sleet, snow or hail either mingled with a fine rain or in a partially melted condition before the surface of the earth is reached. Sleet may be produced by the simultaneous precipitation of snow or hail from a superior, and of rain from an inferior, stratum of the atmosphere. Its formation is usually due, however, to the partial melting of snow or hail in passage through an upper stratum of air above 32° F., and its subsequent re-freezing upon traversing a lower stratum whose temperature is below the freezing point.

Sleigh, a vehicle moved on runners for the conveyance of loads over frozen snow or ice, or over the bare ground; called also a *sled.* Also a kind of traveling carriage mounted on runners, much used in Russia, Canada, and other northern countries during winter, instead of wheel-carriages.

Slemmer, slĕm'ĕr, **Adam Jacoby,** American soldier: b. Montgomery County, Pa., 1828; d. Fort Laramie, Kan., 7 Oct. 1868. He was graduated from West Point in 1850, assigned to the artillery, fought in the campaign against the Seminole Indians in Florida, and in 1851–5 was engaged on frontier duty in California. He was assistant professor of geography and history in 1855 at West Point, and of mathematics in 1856–9. In 1860 he was ordered to Florida and was promoted major in 1861, served for a time as inspector-general of the Department of the Ohio, and in 1862 was attached to Gen. Buell's army. He was appointed brigadier-general of

Digitized by Google

volunteers in 1862 and at the battle of Stone River, 31 Dec. 1862, he was severely wounded, incapacitating him from further active service in the war. He was promoted lieutenant-colonel in 1864, and in 1865 was brevetted colonel and brigadier-general in the regular army for gallantry. He was mustered out of the volunteer service in 1865, and assigned to the command of Fort Laramie, Kan.

Slicer, slī'sėr, **Thomas Roberts,** American Unitarian clergyman: b. Washington 16 April 1847. He was a Methodist minister for ten years, then entered the Unitarian ministry, and since 1897 has been pastor of the Church of All Souls, New York. He is the author of 'Doctrine of the Unity of God in the First Three Centuries' (1893); 'The Power and Promise of the Liberal Faith' (1900); 'Book of Common Worship'; 'The Great Affirmations of Religion' (1900).

Slick'ensides, a miner's term for the striæ, furrows, or polished surfaces covering the walls of fissures, and sometimes the surfaces of bed rock. They result from the friction of two portions of rock moving one against the other under great pressure. The phenomenon is common, being often found on the two walls of faults and joints. It sometimes results from the friction of the mass of a vein moving in a fissure. Slickensides are oftenest found in joints in ore-bearing rocks, but not necessarily so. In the following example noted by James D. Dana, not only the fissure walls but small bits of rock are slickensided: "In the Triassic of East Haven, Conn. (on the borders of New Haven), the successive beds of red granite sandstone . . . . have been shoved over one another upward along the plane of bedding, producing great slickensided surfaces; and these surfaces have generally a very thin and hard white coating, apparently due to ground-up feldspar. In the same region . . . there are also ordinary faults with slickensided walls; and in many places the rock is in fragments, and all the fragments, even those no larger than the hand, indicate participation in the movement by the slickensides which cover them." Consult Jas. D. Dana's 'Manual of Geology' (1895).

Slidell, slī-dĕl', **John,** American politician: b. New York 1793; d. London 29 July 1871. He was graduated at Columbia in 1810, studied law, and in 1819 removed to New Orleans. From 1829 to 1833 he served as United States district attorney for Louisiana; was a member of Congress, 1842–5; and in 1845 was appointed minister to Mexico, but was not received by the Mexican government. In 1853 he entered the United States Senate, but resigned when Louisiana seceded in 1861. In September of that year he was appointed as associate of James M. Mason (q.v.), commissioner of the Confederate States to France. The two commissioners ran the blockade of Charleston, S. C., and sailed from Havana on the English steamer Trent. The Trent was overhauled 8 November by Captain Charles Wilkes (q.v.) with the San Jacinto of the United States navy. The two commissioners were arrested and held for a while as prisoners at Fort Warren in Boston harbor. The act of Wilkes was disavowed by the United States upon demand of the British government, and 1 Jan. 1862 the commissioners sailed for England. Slidell's mission which, besides other things, contemplated recognition of the Confederacy by the French government, failed in its object, France refusing to move, either in that matter or in making a commercial convention, without the co-operation of England. He was successful, however, in securing a large loan for the Confederate States. After the war Slidell settled in London. See TRENT AFFAIR.

Sliding Rule, an instrument for performing various mathematical operations in a mechanical way. It consists of two graduated and numbered pieces of wood or other material, one of which slides in a groove in the other. The instrument is used in measuring surfaces and solids, in gauging, the mensuration of timber, etc.

Sliding-scale, in economics, (1) a scale of prices for manufactured goods, which is regulated by the rise and fall in the price of the raw material. (2) A scale of wages which rises and falls in proportion to the rise or fall in the market value of the goods produced. The name was given to two methods adopted in England for raising the duty on imported wheat and other cereals when they became cheap, and lowering it when they became dear.

Sliding-keel. See CENTRE-BOARD.

Slieven, slē'vĕn, **Sliven,** or **Slivno,** Bulgaria, in Rumelia, 70 miles north of Adrianople, near the famous "Iron Gate." It is an industrial town; the chief manufactures are homespun cloths, attar of roses, and black wine, for which it is famous. There is an extensive trade in the chief products and manufactures, and some in silk. At the annual fair an extensive business is transacted. Pop. about 26,000.

Sligo, slī'gō, **Ireland,** (1) Capital of county Sligo, on a bay of the same name, 110 miles northwest of Dublin, on the Garvogne River. The chief buildings are a Roman Catholic cathedral, town-hall, lunatic asylum, etc., also an abbey of the 15th century. Its industrial works are corn- and saw-mills, and a brewery. The exports are cattle and agricultural produce, especially to Glasgow and Liverpool. Sligo was in early times a walled city with a castle for protection (1242), and its beginning was a Dominican abbey. Nearby is a group of cromlechs.

(2) Sligo is a coast county of Connaught, and comprises 707 square miles. The coast bays are numerous, and the largest are Killala and Sligo Bay. The highest points are Slieve Gamph and the Ox mountains (1,770 feet). Lough's Arrow and Gill are picturesque lakes. The Moy, Owenmore, and Garvogne Rivers are navigable. Iron is abundant. Agriculture and stock-raising are the chief occupations. Coarse linen and woolens are manufactured. The principal towns are Sligo, Ballina, Ballymote, and Tobercurry. In the county are found ancient caverns, raths, cromlechs, an ancient abbey at Ballysadare, and a round tower at Drumcliffe.

Slime Mould. See FUNGI.

Sling, a very general instrument of war among the nations of antiquity. The people of the Balearic Islands excelled at the sling, and were much employed in the armies of the Romans and Carthaginians. Livy mentions

Digitized by Google

some tribes still more dexterous than these islanders, who discharged stones with so much force that neither buckler nor headpiece could resist them, and who hit their mark to a hair-breadth. In the book of Judges (ch. xx.) it is recorded that in the town of Gibeah, in the tribe of Benjamin, there were 700 chosen men, left-handed, every one of whom could sling stones at a hair-breadth and not miss.

Slingelandt, slĭn'gĕl-länt, **Pieter Cornelisz van,** Dutch painter: b. Leyden 20 Oct. 1640; d. there 7 Nov. 1691. He was a pupil of Gerard Dow and produced portraits and clever genres, generally dealing with subjects relating to the great guilds or to civic life, and notable for life-like expression, true color and atmosphere, and suffused with a delightful humor. His principal pictures are 'Children Blowing Bubbles' (in the Uffizi, Florence); 'The Unmusical Puppy'; 'The Violin Player'; and 'The Singing Lesson.'

Slip, the inclined plane on which a ship is built, and from which it is launched. The usual inclination is about one in 19. The foundation of a slip must be very solid. A slip for repairing ships is laid with rails running down into the water. A number of small carriages or trucks may be let down or hauled up these rails, and several of them may be combined in such a manner as to form a single large carriage suited to the size of the vessel to be drawn up. The carriage is let down below the keel of the vessel when the water is high enough to allow the latter to float, and when the tide has ebbed so that the vessel rests on the carriage it is drawn up by steam-power.

Slippery Elm. See ELM.

Sliven, slē'vĕn, or **Sliv'no,** Bulgaria, a town in Eastern Rumelia, situated at the south base of the Balkan Mountains, 60 miles northwest of Bourgas. It has a high school, and important manufactures of cloth, as well as of wine and brandy. Its cloth factories are the main source of supply for the Bulgarian army. Pop. about 26,000.

Sloane, slōn, **SIR Hans, English naturalist:** founder of the British Museum: b. Killileagh, County Down, 16 April 1660; d. Chelsea 11 Jan. 1753. He studied medicine in London, Paris, and Montpellier, and in 1684 settled in London for the practice of his profession. In 1685 he was admitted a fellow of the Royal Society, of which he was appointed secretary in 1693, and president in 1727. His 'Voyage to the islands of Madeira, Barbados, Nieves, St. Christopher's, and Jamaica, with the Natural History of the Last' (1707–25) was the result of observations made in the West Indies during his stay as physician to the governor in 1687–9. George I. created him a baronet and physician-general to the forces in 1716, and on the accession of George II. he was named physician in ordinary to his majesty. See BRITISH MUSEUM.

Sloane, Rush Richard, American lawyer and capitalist: b. Sandusky, Ohio, 18 Sept. 1828. He early entered political life, was twice elected probate judge, was a delegate to the convention which organized the Republican party in 1856, and a prominent member of various political committees and conventions. He was conspicuous in the abolition movement and was prosecuted by the United States government in 1852 for having defended six runaway slaves, the only person prosecuted for that offense under the Fugitive Slave Act of 1850. He was appointed general agent of the post-office department by President Lincoln in 1861, assisted in the organization of the «Cassius M. Clay Brigade» for the protection of Washington in 1861, and served as one of its members. He was mayor of Sandusky 1879–81, built the «Big Four» railroad between Springfield and Columbus, Ohio, was railroad president for 10 years and is largely interested in various commercial enterprises.

Sloane, Thomas O'Conor, American scientist: b. New York 24 Nov. 1851. He studied at Columbia, and was professor of natural sciences at Seton Hall College, N. J. He invented the self-recording photometer, the first instrument to record mechanically the illuminating power of gas; described a new process for determining sulphur in illuminating gas, and has lectured on scientific topics. He is the author of 'Home Experiments in Science' (1888); 'Electricity Simplified' (1891); 'Standard Electrical Dictionary' (1892); 'Liquid Air and the Liquefaction of Gases' (1899); etc.

Sloane, William Milligan, American historian: b. Richmond, Ohio, 12 Nov. 1850. He was graduated from Columbia in 1868, studied at the universities of Berlin and Leipsic in 1872–6, acting during much of that time as private secretary to George Bancroft, then United States minister at Berlin. He was professor at Princeton in 1876–96, edited the 'Princeton Review' in 1886–9, and since 1896 has occupied the Seth Low chair of history at Columbia. He has published: 'The French War and the Revolution' (1893); 'Life of Napoleon' (4 vols. 1897); 'The French Revolution and Religious Reform' (1901); etc.

Sloat, slōt, **John Drake,** American admiral: b. New York 1780; d. New Brighton, Staten Island, N. Y., 28 Nov. 1867. He was appointed a midshipman in the navy in 1800, but was mustered out in the following year after the passage of the peace establishment act. At the outbreak of the War of 1812 he re-entered the navy as sailing master of the frigate United States, and for gallant conduct in the capture of the British Macedonian by the United States received a silver medal and the thanks of Congress. He was engaged in the expedition for the suppression of the West Indian pirates in 1823–5, holding chief command after 1824, captured the pirates Palmyra and Colfrecinos and the pirate stronghold Foxhardo in Porto Rico. He was promoted master-commandant in 1826, captain in 1837, and in 1840–4 was in command of the Portsmouth navy yard. He commanded the Pacific squadron in 1844–6, had charge of the Norfolk navy yard in 1847–51, and then superintended the construction of the Stevens battery. He was retired in 1861, but received rank as commodore in 1862 and as rear admiral in 1863.

Slocum, slō'kŭm, **Henry Warner,** American soldier: b. Delphi, Onondaga County, N. Y., 24 Sept. 1827; d. Brooklyn, N. Y., 14 April 1894. He was graduated from West Point, but resigned his commission and started upon the practice of law. When the Civil War broke out he was commissioned colonel of volunteers

Digitized by Google

in the Union army. He was at the first battle of Bull Run, was made brigadier-general in 1861, and major-general in 1862. He then commanded a corps of the left wing of Sherman's army, which he led on the «march to the sea.» After the war was over he resigned, resumed the practice of law in Brooklyn, and sat in Congress 1869–73.

Slocum, Joshua, American navigator: b. Annapolis County, Nova Scotia, 20 Feb. 1844. He engaged in a seafaring life from early boyhood, studied nautical astronomy and marine architecture, and for many years sailed from the coast of California to points in China, Japan, Australia, and the Spice Islands. In 1874 he built a steamer of 90 tons register at Olongapo, Subig Bay, Luzon, and in 1892 built at Fairhaven, Mass., the Spray, of 9 tons register, in which he sailed alone around the world in 1898. He published serially in leading magazines accounts of his voyages in the Spray and in the Destroyer and has also written: 'Voyages of the Liberdale from Brazil to New York' (1891); 'Voyage of the Destroyer' (1894); 'Sailing Alone Around the World'; etc.

Slocum, William F., American educator: b. Grafton, Mass., 29 July 1851. He was graduated from Amherst in 1874 and from Andover Theological Seminary in 1878. He held Congregational pastorates at Amesbury, Mass., 1878–83, and Baltimore, Md., 1883–8. He subsequently became president of Colorado College. He has written on sociological subjects.

Sloe, or **Blackthorn,** a European shrub (*Prunus Spinosa*), from 2 to 15 feet high, much branched, and very spiny. The small, white, rosaceous flowers appear before the leaves, which are alternate, ovate with obtuse tips, and finely serrate. The fruit is a globose drupe about as large as a cherry, almost black in color, with a bloom, and containing a stone slightly flattened and acute on one edge. Its variety, the bullace (*P. insititia*), has by some been called a species, and is supposed to be one of the plants from which European plums originated. The pits have been found in Swiss lake-dwellings, and the fruits have been used for preserves, for making fictitious port, and adulterating the genuine wine, and for a black dye. The leaves were an adulterant of tea, and the stem furnishes the knobby «blackthorn» stick of Irish fame.

Sloop. See SHIP: SAIL AND STEAM.

Slos'son, Annie Trumbull, American author: b. Stonington, Conn. She is a sister of J. H. Trumbull (q.v.). She is well known as a short-story writer, is interested in entomological and botanical investigations, and has published: 'Dumb Foxglove' (1898); 'Story-tell Lib' (1900); 'White Christopher' (1901); 'Aunt Abby's Neighbors' (1902); etc. One of her best known short stories is 'Fishin' Timmy.'

Sloth, an edentate mammal of the family *Bradypodidæ*. (See EDENTATA.) The best known are the unau or two-toed sloth (*Cholœpus didactylus*) of Brazil and the ai or three-toed sloth (*Bradypus tridactylus*) of northern South America. This family is distinguished by the flat short head, and the elongated legs, furnished with powerful compressed and curved claws. No incisor teeth exist, but simple columnar molars without enamel are developed. The stomach is somewhat complex. The three-toed species are unique among mammals in possessing nine cervical vertebræ. The long bones are solid, and destitute of marrow or medullary cavities. Being adapted solely for an arboreal life, the fore-limbs exhibit a much greater length than the hind-limbs, and a powerful muscular organization. The fore-arm possesses an unusual degree of mobility, the feet being strong and the claws very powerful and permanently flexed. The usual mode of progression of these animals is to move back downward suspended from the branches of trees, and they are known to sleep in this curious position. On the ground the sloths are entirely out of their element; the feet being jointed in an oblique manner to the limbs, the palms and soles are thus naturally turned inward, and the claws themselves are bent inward toward the soles of the feet. Three toes exist in this species, and its general color is a brownish gray, with darker tints on the face and limbs. The fur is of very coarse character, and when the animals are living in their damp native forests is tinted green from the presence upon it of a minute green plant or alga. The unau, as its specific name implies, has but two toes, and 23 pairs of ribs exist, no mammal possessing a greater number than this. Its average length is about two feet, and its color is a lighter gray than that of the ai. The tail in both species is either wanting, or at the most is rudimentary. The sloths are proverbially sluggish in their movements and are remarkably tenacious of life. They are nocturnal and feed upon leaves and shoots which are secured with the slender prehensile tongue. Generally only the two genera mentioned above are recognized, but by some zoologists the three-toed sloths are subdivided. The number of species is also doubtful. About 15 have been described, all confined to South and Central America. The Megathium, Mylodon, and similar genera were gigantic sloth-like terrestrial animals, the remains of which are found abundantly in the Pleistocene deposits of North and South America.

Consult: Flower and Lydekker, 'Mammals Living and Extinct' (London 1891); Leidy, 'Extinct Sloth Tribe of North America' (Washington 1855).

Sloth-bear, or **Aswail.** See BEARS.

Sloth-lemur, or **Slow Lemur.** See LEMURS.

Slough Grass. See FIBRE.

Slovaks, slō-väks', the name of the Slavic inhabitants of northern Hungary. They are the descendants of the Slavs that settled on the south of the Carpathians between the Danube and the Theiss, where they maintained themselves for centuries, and in the 9th century formed the nucleus of the great Moravian empire. After the battle of Pressburg, in 907, in which this empire was overthrown by the Magyars, the Slovaks gradually fell under the yoke of the conquerors. At the present day they are scattered over most of the counties of Hungary, and in the northwestern counties they form the majority of the inhabitants. They are also found in Moravia in the districts adjoining Hungary, and in detached settlements in Lower Austria, Bukowina, and Slavonia. The Slovaks possess in their own dialect a number of beauti-

Digitized by Google

ful popular songs, collections of which have been published at different times (Pest 1823–27; Buda 1834). There is a grammar of the language by Victorin (Budapest 1878). The total number of Slovaks is about 2,000,000. See SLAVS.

Slove'nians, the native name of the Slavic inhabitants of Styria, Carinthia, Carniola, the Austrian maritime territory, a narrow strip in the west of Hungary, and in Venetian Friuli. By the Germans they are often called Wends or Winds. They settled in these districts toward the end of the 6th century, having migrated there from Pannonia. Christianity was introduced among them not later than the 8th century. Their land was incorporated under the name of the Windic March with the empire of Charlemagne. Out of this march were afterward formed the duchies of Styria, Carinthia, and Carniola, which fell to Germany and ultimately to Austria. Their total number is about 1,200,000. The language of the Slovenians is closely allied to the Servian. (See SLAVS.) It possesses some very old and valuable monuments of the Slavonic tongue. The oldest, which is at the same time the most ancient of all the Slavonic literary relics, is the Munich manuscript, of the date 957–994, written by Bishop Abraham, of Freising, in Bavaria, and consisting of three pieces on religious subjects. It is printed in Kopitar's 'Glagolitza Clozianus' (Vienna 1836). After a long slumber the dialect was resuscitated for literary purposes in the 16th century, when several ecclesiastics brought it to a high state of development. In 1584 Bohoricz published a grammar of the language, and in the same year there appeared a translation of the whole Bible. The best grammar is that of Kopitar (Laibach 1808). A dictionary by Jarnik and Mark was published in 1832, and collections of popular songs were published by Wraz and by Korytko in 1839.

Slow-worm, or **Blind-worm,** a limbless, snake-like lizard (*Angius fragilis*) of Europe which creeps about beneath dead leaves, in rotting logs, etc., in search of insects. It is 15 to 20 inches in length, smoothly scaly, brown striped; and perfectly harmless.

Slowacki, slō-vä'kē, **Julius,** Polish poet: b. Kremenecz, in Volhynia, 23 Aug. 1809; d. Paris 3 April 1849. He was educated in the University of Vilna. His first work was the poetic tale 'Hugo'; this was followed by the tragedy 'Mindowe' (1829); the poem 'Mnich' (the 'Monk'); and the tragedy 'Marya Stuart' (1830); in all of which he was under the influence of Byron; but escapes from it in the 'Ode to Liberty'; 'Hymn to the Mother of God'; and 'Song of the Lithuanian Legion' (1831). The sentiment of Polish nationality finds fullest expression in the dramatic poem 'Kordyan' (1834), and in the tragedy 'Mazeppa.' Slowacki reaches the height of his lyric power in the poem 'In Switzerland.' His last great work, left incomplete, was 'King Spirit,' which he designed to be a 'Legend of the ages' of Polish history.

Sloyd. See MANUAL TRAINING.

Slugs. See SNAILS AND SLUGS.

Sluice, in hydraulics, a frame of timber, stone, or other solid substance, serving to retain and raise the water of a river or canal, and when necessary, to give it vent. Hence, an opening; a source of supply; that from which anything flows; as, the eyes are the lachrymal sluices of sensibility. The word is also applied to the stream of water issuing through a floodgate. See MINING.

Smack, a small vessel rigged as a cutter, sloop, or yawl, used in the coasting trade and in fishing.

Smalcald, smăl'kâld, or **Schmalkalden,** shmäl'käl"dĕn, Prussia, a town in the district of Cassel, on the south slope of the Thüringer Wald, 58 miles southeast of Cassel. It is an interesting town containing a Gothic church built in the 15th century, and the Wilhelmsburg Castle, in which there is a collection of antiquities. In the old town hall the Smalcaldic League was concluded in 1530 and the Smalcaldic Articles signed in 1537 by the Protestant leaders. The town has several institutions for higher education, and a trade-school for the iron and steel industry is the most important. Population about 9,000.

Smalkal'dic League. See SCHMALKALDIC LEAGUE.

Small Arms, American. Included under this title are the various types of American firearms that from their portable form may be classed as hand weapons, as distinguished from ordnance.

For many years after the arrival of the early colonists, imported weapons were used in America almost exclusively. On the Continent especially among the Germans, Swiss, and French, much attention had been given to the production of arms of precision and greater progress had been made than in England. The Puritan settlers in New England remained satisfied with their matchlock and flintlock smooth-bore arms until the Revolutionary period. Their traditions and training were such that the use of deadly weapons, excepting in cases of defense from enemies and for the purpose of obtaining game in order to sustain life, was frowned on as a practice to be discouraged.

It is to the Teutonic settlers of Pennsylvania that we must turn for the earliest examples of typical American weapons. Peter and Heinrich Leman established themselves near Lancaster, Pa., at the beginning of the 18th century and in 1732 were making rifled arms.

Naturally the first rifles produced were of the contemporary German model, short-barreled, ungainly pieces of large bore. They were flintlocks, loading from the muzzle, a mallet being necessary in order to start the bullet into the deeply cut rifling, considerable pressure being afterwards required in order to seat the bullet down upon the powder charge. The frontiersmen appreciated the value of an arm that gave the accuracy of which these weapons were capable as compared with smooth-bore muskets.

But such laborious methods of loading were impracticable under conditions of Indian warfare and in the pursuit of dangerous game. So the linen or buckskin patch, impregnated with tallow, was devised to be wrapped about the bullet when loading. This seated readily and the rifles were found to shoot farther and truer than by the previous method. By lengthening the barrel greater accuracy as well as ease of sighting

Digitized by Google

and steadier holding ensued. The barrel was usually from 40 to 45 inches in length, octagon, and of a bore of from 35 to 40 round balls to the pound. The stock was maple or walnut extending the full length of the barrel, the ramrod being carried in a slot underneath. A cheekpiece was fashioned near the breech, also a patch box, and the butt of the stock terminated in a crescent-shaped plate to be held against the upper arm instead of the shoulder. The locks were generally fitted with single or double set triggers. The stock was intentionally slender and light, the total weight of the rifles being about ten pounds. Sights were very low on the barrel, consisting of an oval silver blade at the muzzle and at the breech a straight bar with a fine notch, frequently inlaid with a narrow vertical strip of silver. Though the range of these rifles was seldom effective beyond 200 yards, within that distance great precision as well as a flat curve of trajectory was secured, the proportion of the weight of the bullet to the powder charge being about three to one.

In the Far West a change in model was made in order to adapt the rifle to the conditions of buffalo hunting and use on horseback. A rifle of this type made in Missouri in 1820 has a 34-inch octagon barrel with a maple stock extending half way to the muzzle. The bore is slightly over one half inch in diameter, and a charge of about 90 grains of powder was used. This arm has double set triggers and weighs about 10½ pounds.

In the South the standard rifle was of relatively small bore. Bullets of about 70 to 80 to the pound were found to be sufficient for still hunting the small game of the section, such as wild turkeys and squirrels. Though larger calibres were to be found to a certain extent, the Kentucky smallbore rifle attained a widespread reputation.

The sport of target or turkey shooting from an artificial rest at distances up to 40 rods developed a type of rifle which while very accurate was useless for field purposes, weighing from 20 to 40 pounds. A bore of from .40 to .60 calibre was customary with an elongated projectile, and telescope sights were frequently applied. Carlos Clark of Windsor, Vermont, in 1836 adapted the false muzzle for the purpose of preventing wear on the rifling when loading and it was generally used with this style of arm.

The first military weapon employed by the United States government was the Charleville musket, the national arm of France, which was brought to this country in large quantities during the Revolutionary War through the influence of Marquis de Lafayette. The French model of 1763 served as an example for American private manufacturers who were encouraged by the government. These muskets were heavy smooth-bore flintlocks taking an ounce ball and fitted with bayonets. In 1795 the Government Armory at Springfield, Mass., was established and the manufacture of muskets by the government commenced during that year. The Charleville musket as improved in 1797 continued to be the standard type of military weapon. The Harper's Ferry Armory was established in 1796, but the fabrication of arms was not begun until 1801. In 1804 rifles were produced there in small quantities. A rifle resembling the sporting model of the period was brought out at this armory in 1814. It had a half octagon barrel, short forestock, no bayonet and a curved butt plate, and was adapted to a one half ounce ball. The Hall rifle, issued in 1818, was the first breech-loading rifle to be manufactured by the government. It was originally a flintlock, but was later changed to a percussion lock arm. In 1822 the muzzle-loading principle was still retained in the musket and rifle of that date, issued as a new model. The musket and rifle of the model of 1842 were the first service weapons to be originally made with percussion locks.

During the Civil War a great variety of arms were in use. The percussion principle was applied to many of the flintlocks in the possession of the government and the muskets and rifles made in the government armories were adapted to that style of ignition. Breech-loading rifles and carbines of private manufacture were purchased in large quantities, several types of repeating arms doing excellent service. Foreign weapons were also used to some extent, especially in the Confederate service.

At the close of the war the government deemed it desirable to transform the large number of muzzle-loading rifles on hand into breechloaders. Many devices for this purpose were submitted to the Ordnance Board and that presented by Smoat, a mechanic at the Springfield armory, was adopted, and the rifles were known as the model of 1865. The progress in the development of ammunition resulted in the production of the rim fire cartridge, a great improvement over the powder and ball charge enclosed in paper previously in use. Centre fire cartridges of .58 calibre, the brass shell containing 70 grains of powder and 450 of lead, became the standard ammunition for the later rifles of this model. In 1868 the calibre was changed to .50, retaining the same weight of bullet and powder charge.

In 1870 the Ordnance Board recommended for trial from the many rifles submitted to them, the Remington, Sharps, and Ward-Burton, all taking the regulation .50-calibre cartridge. They were all tried in the field, the verdict being that none of them were superior to the Springfield. A reduction in calibre was recommended, however, resulting in the model of 1873 Springfield rifle, calibre .45, taking 70 grains of powder and a 405-grain bullet. In 1885 a bullet weighing 500 grains was adopted as the standard for this cartridge.

The .45-calibre Lee-Remington, and later the .236-calibre Lee straight pull rifles, both embodying the bolt mechanism, were adopted for the United States Navy.

Flintlock pistols of large calibre and smooth bore were considered an indispensable weapon of defense during the early history of our country, no traveler on horseback or by stage feeling secure unless one of these weapons was in his possession. Accuracy was a secondary consideration, as they were intended to be used only at short range, and hence were frequently loaded with buckshot as well as with single bullets. Duelling pistols were of a different model, the stocks being attached at an extreme angle with the barrel in order to allow the owner to assume the approved duelling position, with the elbow close to the body. These pistols were made in pairs and they frequently showed a high degree of skill on the part of the makers, being elaborately engraved and inlaid.

Digitized by Google

In 1830 Samuel Colt began to devote his attention to developing a pistol with a revolving cylinder containing a number of chambers. His efforts were soon crowned with success, and his revolvers gained a wide reputation. The cylinders were loaded from the muzzle with powder and ball, each chamber containing an independent breech-pin adapted to a percussion cap. These weapons were made with a solid frame. Metallic cartridges added much to their utility. Smith & Wesson brought out a revolver with a hinged frame, allowing the chambers to be exposed for loading and the simultaneous ejecting of the discharged shells. The products of these two firms soon became the models for manufacturers throughout the world.

For hunting rifles the breech-loading system came into general use during the period of the Civil War. In the West the Sharps .45-calibre rifle chambered for a cartridge containing from 90 to 120 grains of powder and a 550-grain bullet, paper patched, was the standard buffalo hunter's weapon. These rifles weighed from 11 to 16 pounds and were usually equipped with set triggers.

The magazine principle was making rapid advances at this time. In the Henry rifle, the predecessor of the Winchester, the cartridges were loaded into a tube under the barrel, being forced by a spiral spring into the carrier and thrown into the chamber by the action of the lever forming the trigger guard. The standard cartridge remained the .44-40-200 in both rim and later central fire. In 1870 the express principle attracted the attention of sportsmen, consisting in the use of a large powder charge in proportion to the weight of the bullet in order to obtain a high velocity and increased striking power on large game. The .45-90-300 cartridge was one of a number brought out in response to this demand and adapted to the repeating system of rifles.

The formation of the National Rifle Association in 1871 resulted in a series of international long-range rifle contests in which the American teams won a majority of the matches both at home and abroad. The weapons used were of .44 and .45 calibre with from 90 to 120 grains of powder and paper patched bullets of from 500 to 550 grains of hardened lead. The limit of weight of these rifles was 10 pounds and the minimum trigger pull 3 pounds. Great skill was shown in the manufacture of these rifles and the results attained have not been surpassed in accuracy by later developments in weapons.

Target shooting as a sport became popular throughout the country as a result of these contests and as many clubs were unable to obtain facilities for long-range practice, shooting at 200 yards in the standing position was widely adopted. The large bore rifles and heavy charges in use at the longer ranges were found to be unnecessary and a gradual reduction in calibres took place. For some years the limit of weight remained at 10 pounds. At the German-American schuetzenfests there were no restrictions as to the weight of the rifle or the trigger pull, and these weapons while impracticable in the field were nevertheless superior for their specific purpose. Hence a change in type in offhand weapons has come about and the standard weapon is the schuetzen model, weighing from 11 to 15 pounds. The .32 and .38 calibres are usually adopted. These rifles are frequently equipped with a palm rest, a rod extending down from the forestock, terminating in a knob, enabling the marksman to rest the left elbow on the hip. A cheekpiece, buttplate with horns to fit the arm, double set triggers, an aperture or pin head front sight covered with a hood, and a rear elevating vernier sight with a wind-gauge attachment on the tang of the rifle complete the outfit. Telescope sights are increasing in numbers. Lubricated grooved bullets slightly hardened with tin are used, many expert riflemen loading them through a false muzzle, the shell being afterwards inserted at the breech. The advantages claimed for this system are the perfect fitting of the bullet to the grooves and the cleaning of the bore as the bullet is forced down through the rifling. Such weapons are capable of placing ten shots in a two-inch circle at 200 yards from a machine rest.

Target shooting with the pistol and revolver at distances up to 50 yards is a popular sport, encouraged by the United States Revolver Association. The modern single shot target pistol has a 10-inch barrel and is made in calibres of from .22 to .44, .22-calibre rim fire ammunition being generally favored. The accuracy obtainable is surprising, 10 shots having been placed in a 3-inch circle at 50 yards, the weapon being shot in the regulation position with the arm extended, free from artificial support. Revolvers for target purposes are usually of from .32 to .44 calibre, with barrels from 6 to 8 inches in length.

Muzzle-loading shotguns both flintlock and percussion were almost exclusively imported from England and the Continent. The products of Joseph Manton were unsurpassed for balance fine shooting qualities and workmanship and served as models for American fowling pieces. Barrels and locks were largely imported, in fact it is only within a comparatively few years that many shotgun barrels have been made in this country. The introduction of the Lefaucheaux breech-loading system from France in 1852 marked a great advance over previous inventions. A paper and brass shell was used with a small percussion cap in the centre of the base of the cartridge, ignited by the blow of the hammer on a brass pin extending through the side of the head of each shell, this pin also affording a means for withdrawing the empty case. The barrels were hinged, the breech being opened for the insertion of the shells by means of an under lever. This system formed the basis for most American breech-loading actions for double and single guns. Improvements have been made from time to time until to-day the American hammerless ejecting gun operated by a top lever using centre fire shells is second to none. The various styles of single trigger mechanisms are gaining in popularity. The repeating shotgun is distinctly American, the mechanism in most cases being operated by the sliding motion of the fore end.

The various types of weapons we have mentioned have been developed during the era of black powder, a propellant which while producing remarkably uniform results has changed but slightly in its constituents during the past century.

The introduction of smokeless or nitro powders has marked a new era in the field of firearms. Its characteristic features are absence

Digitized by Google

of smoke and fouling, reduced recoil, reduction in bulk, and the attainment of high velocities with relatively low chamber pressures.

In military weapons smokeless powder was at once conceded to possess obvious advantages. During the Spanish-American war smokeless ammunition was made in large quantities for the .45-calibre Springfield rifle. The Ordnance Board after careful investigation adopted 15 Sept. 1892 the Krag-Jorgensen .30-calibre rifle. This arm, now in the hands of the government forces, is of the bolt operated type, weighs 9¼ pounds without the bayonet and has a magazine holding five cartridges. The cartridge contains a bullet of 220 grains, consisting of a lead core and a steel jacket, the charge of smokeless powder giving a muzzle velocity of 2,000 feet per second as compared with 1,300 feet for the .45-calibre Springfield. A marked reduction of recoil, a flat curve of trajectory, and economy in the weight of ammunition, as well as a great gain in rapidity of fire are notable features. A 10-inch twist is required to properly rotate the long bullet.

In 1900 the Ordnance Board began a series of experiments with a new weapon known as the .30-calibre Springfield. The breech mechanism resembles in many respects a form of the foreign Mannlicher bolt action, which has given excellent satisfaction. The magazine is of the box type and is situated under the receiver. The cartridges are loaded from a clip, the magazine being provided with a cut-off, so that the weapon may be used as a single loader if desired. Twenty shots have been fired in government tests in 28⅜ seconds. The cartridge has a cannelure cut around the head to engage in the extractor in place of the flange on the Krag-Jorgensen ammunition, allowing the cartridges to lie compactly in the magazine. The 220 grain jacketed bullet is retained, the powder charge being increased in order to give a muzzle velocity of 2,300 feet per second.

The telescope sight is receiving attention for the equipment of military sharpshooters. The hyposcope, a detachable instrument consisting of a series of mirrors in a tube extending below the line of sight, allowing aim to be taken without the body of the soldier being exposed, has recently been placed before the Ordnance Board for adoption.

In hunting rifles the jacketed bullet and smokeless powder have found instant favor. For this purpose the lead core of the bullet is exposed at the point and upon striking game it expands or mushrooms, making a most deadly wound. Though the .30-40 government cartridge with a soft nosed bullet is largely used a number of special cartridges have been designed. The .405 Winchester adapted to their repeating rifles, contains a 300 grain bullet, the smokeless powder charge developing a muzzle velocity of 2,204 feet per second and a muzzle energy of 3,235 foot pounds.

The application of smokeless powder to revolver ammunition has resulted in increased efficiency as an unlimited number of shots may be fired with no perceptible fouling of the barrel or cylinder and a degree of accuracy maintained which was unattainable in the days of black powder.

Shotgun cartridges are almost exclusively loaded with this propellant and American machine made guns are now being produced in weights of from six to seven pounds without the recoil becoming excessive or general effectiveness being sacrificed. The imported twist barrels have given way to special steel barrels of light weight and great tensile strength.

Automatic firearms have within the past few years attracted much attention. The term automatic literally means an arm that continues its acts of loading and firing after the first shot until the ammunition is exhausted. The arm that after firing the first shot performs the work of ejecting the empty shell, recharges the chamber, and leaves the arm ready for the next shot by merely pressing the trigger, is a semi-automatic firearm, but the term automatic has been generally applied to this weapon. There are two systems in vogue at present, that by which a portion of the gas from the explosion is utilized to operate the breech mechanism, the other in which the barrel recedes by the action of the recoil and accomplishes the same result. The latter system has been successfully applied to American repeating pistols which are a marked improvement over the revolver, as in the latter there is an inevitable escape of the explosive gases between the cylinder and the barrel. Metal jacketed bullets and smokeless powder are used in these repeating pistols. Small bore rifles designed on the recoil operated system are a popular weapon and a repeating semi-automatic shotgun is now before the public.

There are many excellent types of firearms in use that seem well adapted for all time, but progress is constantly being made. The automatic and semi-automatic weapon will be an important factor in the warfare and sport of the future. See ARMS and ARMOR; ARTILLERY; ORDNANCE; GUN; MUSKET, RIFLE, etc.

Bibliography.— Barber, 'The Crack Shot' (New York 1873); Chapman, 'Improved American Rifle' (New York 1848); Cleveland, 'Hints to Riflemen' (New York 1864); Freemantle, 'The Book of the Rifle' (London 1901); Gerrare, 'A Bibliography of Guns and Shooting' (London 1896); Gould, 'The Modern American Pistol and Revolver' (Boston 1888); Gould, 'Modern American Rifles' (Boston 1892); Gould, 'Military Rifle Shooting' (Lowell 1902); Greener, 'The Gun' (London 1835); Greener, 'Gunnery in 1858' (London 1858); Greener, 'The Gun and Its Development' (London 1896); Greener, 'Sharpshooting for Sport and War' (London 1900); Hudson, 'Modern Rifle Shooting from the American Standpoint' (New York 1903); Kephart, 'Early American Rifles, in Shooting and Fishing' (New York); Leech, 'Irish Riflemen in America' (London 1875); Marks, 'The Evolution of Modern Small Arms and Ammunition' (London 1898); Ordnance Dept. U. S. Army Reports, Washington; Teasdale-Bucknell, 'Experts on Guns and Shooting' (London 1900); Tippins, 'Modern Rifle Shooting in Peace, War, and Sport' (London 1900); U. S. Cartridge Company, 'Catalogue of Collection of Fire Arms' (Lowell 1904); Van Dyke, 'The Still Hunter' (New York 1904); Walsh, 'The Modern Sportsman's Gun and Rifle' (London 1884); Weston, 'The Rifle Club and Range' (New York 1879); Wilder, 'Rifles and Rifle Shooting' (Boston 1892); 'Guns, Ammunition and Tackle' (New York 1904).

JOHN TAYLOR HUMPHREY,
Editor 'Shooting and Fishing.'

Digitized by Google

Smalley, smâl'ĭ, **George Washburn**, American journalist: b. Franklin, Norfolk County, Mass., 2 June 1833. Graduated from Yale in 1853, he read law, and, having been admitted in 1856 to the bar, practised in Boston until the commencement of the Rebellion, when he became correspondent in the field of the New York *Tribune*. From November 1861 to October 1862 he acted as war correspondent, first in South Carolina, then in Virginia in the campaigns of the Shenandoah and the Potomac, then was on the editorial staff till 1867, and in that year organized the *Tribune's* European bureau in London. There he remained in charge of all European correspondence until 1895, when he returned to the United States as American correspondent of the London *Times*. His publications are: 'Review of Bright's Speeches' (1868); 'London Letters' (1890); 'Studies of Men' (1895).

Smallpox. There is no knowledge as to the first appearance of smallpox in Europe. It is believed that some of the great epidemics, as the Attic plague, which devastated Athens in 430 B.C., and the plague of Antoninus, which appeared in Italy 165 A.D., were epidemics of smallpox, but the descriptions are too indefinite for accurate recognition. The first medical description of the disease comes from two Arabian physicians, Abu Jakub Ben Ischaac and Muhamed Ben Rhazes at the end of the 9th century and the beginning of the 10th. Up to the beginning of the 12th century the disease was practically constant in Europe. Occasionally a place would remain free for a number of years, then the disease would again appear. Its periodical invasions were rather to be referred to the accumulation of individuals who had derived no immunity from previous epidemics than to a fresh introduction of the virus. In the 12th century the disease was prevalent in southern and western Europe and in the 13th century there was a smallpox plague in England. Iceland and Greenland were visited by epidemics at intervals, and the greater portion of the population was several times destroyed. Smallpox was introduced into America in 1507, 15 years after the discovery. Since then it has never disappeared, and has been the chief agent in the destruction of the native population. In 1517 the greater part of the population of Santo Domingo was destroyed, and it is said that in 1520 3,500,000 in Mexico died of the disease. Many epidemics in later years were due to the importation of slaves from central Africa, where the disease has been and is constant.

In the 16th and 17th centuries there were numerous epidemics in Europe, among the most marked of which were those in France in 1577 and 1583, in which the mortality was so great that most of those affected died. The most noted invasion in England was from 1660 until the end of the century. During this time Sydenham studied the disease and wrote his famous descriptions of it. Smallpox was probably never more prevalent than during the 18th century. In places the mortality from the epidemics was almost incredible. In 1770 more than 3,000,000 are supposed to have died in an epidemic in India. Some influence was exerted on the disease by inoculation or variolation, which began to be practised during the 18th century. The introduction of vaccination at the beginning of the 19th century was the first great influence in diminishing the frequency and the mortality of the disease. The importance of vaccination was slowly recognized, and it would be wrong to attribute the comparative infrequency of smallpox from 1800 to 1815 to this, but rather to the fact that the susceptibility of the population had been diminished by the almost universal distribution of the disease in the latter part of the 18th century. At that period the general distribution was materially assisted by wars and movements of armies. The most extensive prevalence in the 19th century was in Russia. The mortality was frightful in the year 1856, reaching in some places 80 per cent. In many places nearly all the children in the population died. With the exception of certain places in the tropics, no land experienced such mortality from the disease. There are credible estimates which give the deaths in Russia from smallpox from the beginning of the century to 1871 as 10,500,000. Extensive epidemics in Europe followed the Franco-German war. The year 1874 will always be famous in the annals of medicine as marking the introduction of compulsory vaccination in Germany, and with this smallpox practically disappeared from that country. There have been small epidemics in various places in America and Europe in recent times, and the disease is now mildly present in almost every State of the Union.

This disease is independent of conditions of soil and climate. It has flourished equally well in the tropics and in the frozen North. There is no disease to which the entire human race is so susceptible, though there is some difference in race susceptibility. The negro is generally regarded as more susceptible than the white race.

After exposure of an individual unprotected by vaccination or by a previous attack of the disease, usually no symptoms are manifest for 12 days. This is termed the period of incubation. In rare cases a rash appears, which has no relation to the specific eruption of the disease. This rash, termed the prodromal rash, chiefly affects the groin and axillæ, parts which are usually least affected by the specific eruption. After the period of incubation the disease begins with a sudden onset. In adults a chill, and in children convulsions, are the common initial symptoms. There may be repeated chills in the first 24 hours. There is usually headache, with intense pain in the back, chiefly in the lumbar region. Owing to the intense pain, this stage is often productive of more discomfort than the later stages. Vomiting is also common at the onset, particularly in children. The temperature rises quickly to 103° or 104° F. on the first day. In severe cases there may be marked delirium, particularly if the fever is high; the patient is restless and distressed; the face is flushed; the eyes are bright and clear; and the skin is dry, although there may be profuse sweats. On the fourth day after the onset the eruption characteristic of the disease begins to appear. It first appears in small red spots on the forehead, wrists, and hands. In the next 24 hours the spots become more abundant and extend to the extremities, and a few appear on the body. In 48 hours after the first appearance on the forehead the

Digitized by Google

Digitized by Google

SMALL-POX.

Fig. 1. Vaccinia on rabbit's cornea, showing several vaccine bodies in vacuoles adjoining the nuclei of epithelial cells. x 1000 diameters.

Fig. 2. Vaccine bodies in further development, showing the differentiation in structure. From the cornea of a rabbit. x 1000 diameters.

Fig. 3. Small small-pox parasite in protoplasm of epithelial cells of skin, in vacuoles adjoining the nucleus.

Fig. 4. A more advanced stage, showing beginning differentiation of the parasite.

Fig. 5. Larger parasites in stage preceding segmentation.

Fig. 6. Segmentation of parasite; from a case of experimental small-pox in the monkey.

These figures illustrate the first phase of development of the organism within the cell protoplasm. The nuclei are not affected. Microphotographs multiplied 1000 diameters.

Fig. 7. Beginning of intranuclear development. Two nuclei with small round vesicles inclosed.

Fig. 8. Showing farther development. x 1500 diameters.

Fig. 9. Beginning formation of a sporoblast within the nucleus. There are two sporoblasts consisting each of a central vesicle with a series of small chambers around it.

Figs. 10, 11, 12 and 13. The further development of sporoblosts.

Fig. 14. Spore formation with free spores in the nucleus.

Digitized by Google

SMALL POX.

Digitized by Google

Digitized by Google

eruption is generally distributed. In the centre of the red spot a slightly elevated hard whitish spot appears. This is the papule. It enlarges and becomes more transparent from the collection of clear fluid within it. The fluid is confined in small places, so that it is not possible to discharge more than a very minute quantity by pricking with a needle. The transparent appearance of the vesicle into which the papule has become converted is gradually lost, and it becomes white and opaque. If now it be pricked a thick and opaque fluid comes from it. This is pus, the vesicle having become converted into a pustule. A peculiarity of the pustule, which, however, is not always seen, is a sharp depression at the summit. The temperature, which is high at the onset, gradually falls, and during the eruption may be but little above normal. In size and number the pustules or pocks vary. They are always more numerous on the face and extremities than on the trunk. The gravity of the disease has a definite relation to the abundance of the eruption on the face. The full maturity of the lesion is usually reached on the eighth day from the onset. There is usually then a second rise of the temperature, which, after an irregular course, slowly returns to normal. The formation of these lesions is accompanied by a great deal of swelling, due to œdema, in consequence of which the eyes may be closed. If the pustules are comparatively few in number, so that their edges do not come in contact, the disease is called discrete smallpox. If the eruption is more abundant, so that the pustules touch and coalesce with one another, it is called confluent smallpox. The earlier the eruption appears after the onset the more apt is the disease to be confluent, and the graver the prognosis. This confluence of the lesions is more apt to take place on the face than elsewhere. It is rarely that the eruption is so abundant on the body as to become confluent.

At about the tenth day from the onset the stage of desiccation commences. The contents of the pustules disappear, partly by absorption, partly by rupture. Small openings may be formed on the surface, through which the contents gradually exude, and dry to form a crust. In severe confluent cases the entire face may be covered with a thick crust as with a mask. Great pain and distress accompany the eruption. There is frequently intense itching, and it is difficult to restrain patients from aggravating their condition by violent scratching. The pain is due chiefly to the œdema, and is particularly felt in those situations where the skin is densest and most unyielding. The formation of scars depends entirely upon the severity of the eruption. If the pustules are large and confluent, scars inevitably result; in slight cases they may be wholly absent. The scars are pale and depressed. In severe confluent cases, instead of single scars, large cicatricial areas, resembling those formed from extensive burns, may result. The mucous membranes are also the seat of the specific eruption. Circumscribed lesions are often seen in the nose, especially in the posterior portion, on the tongue, and inside of the cheek, on the soft palate and pharynx. They are more rarely found in the larynx and trachea. The eruption runs its course much more rapidly in the mucous membranes than in the skin, and typical pustules are rarely formed. These lesions of the mucous membranes, which form an integral part of the disease, and are of the same character as the skin-eruption, are relatively unimportant in comparison with the lesions which are accidental and produced not by the specific parasites of smallpox, but by bacteria. There may be intense swelling of the mucous membrane, adding greatly to the distress of the patient. The stomach and intestinal canal are never involved in the specific lesions.

There are several varieties of smallpox which depart more or less widely from the type of the disease. In the mildest form there is no eruption. The existence of this form has been denied, but it undoubtedly occurs. It is seen in the course of an epidemic in persons who are much exposed to the disease and imperfectly protected by vaccination. The symptoms of onset appear with fever, which lasts a day or two and then subsides. The condition is probably to be explained by a high resistance to the action of the parasite and the establishment of immunity before the time when the skin-eruption should appear. There is a very mild variety of the disease known as varioloid. In this there is a very scanty eruption, with mild general symptoms. Such cases are also more apt to be seen in persons who have been vaccinated in childhood, and have received some, but not perfect, protection. Certain epidemics are characterized by a very mild course, most of the cases taking this form. Such cases may prove very dangerous in the course of an epidemic, for they are frequently not recognized, and create important foci of infection. These cases are often confounded with, but should be distinguished from, abortive smallpox. In this the onset of the disease is as usual, and the eruption begins as in a severe case. The lesions do not reach their full development into pustules, but rapidly dry up in the early vesicular stage. There is a certain analogy between these cases and smallpox without eruption. The cessation of the development of the skin-lesions is due to the early establishment of immunity, but the immunity is longer delayed than in cases without eruption. In all these cases there does not seem to be any diminution in the virulence of the infectious agent, for the most severe cases may be traced to infection by the most mild.

A tendency to hemorrhage in or near the skin-lesions always marks a severe and generally fatal form of the disease. The earlier in the disease the tendency to hemorrhage appears, the graver is the prognosis. In the most marked type, which is called purpura variolosa, there are extensive hemorrhages in the skin before the eruption appears. The period of incubation is also shorter, and the eruption may not appear at all, or may be limited to a few pustules on the face or ankles. Hemorrhages also take place from the mucous membranes. Such cases are invariably fatal, the end coming usually before the sixth day. The attempt has been made to separate this form of smallpox into a definite variety without any relation to the other forms; cases, however, are seen offering every transition from this to very slight hemorrhages in the skin around the pustules.

There are some striking peculiarities in the distribution of the eruption. If the skin be

Digitized by Google

irritated in any way, the eruption is more abundant over the irritated area. The application of a mustard-plaster will produce in a mild case an abundant eruption over the place occupied by the plaster. The same is true of parts of the skin which are subjected to friction by the clothing or by the occupation of the individual. The abundance of the eruption in such cases seems to be connected with the hyperæmia of the skin. The development of the skin-lesions may be traced microscopically by studying cases at different stages. Changes are apparent on microscopic examination before they can be recognized by the naked eye. In purpura variolosa, although no vesicles or pustules can be seen, the skin shows everywhere the beginning of the lesions. The changes in typical cases are confined to the epidermis, and begin as a degeneration of the cells in the middle layer of this. The cells become swollen and vesicular, and the nuclei irregular and shriveled. Fluid exudation is given off from the vessels in the true skin below, and passes into the epidermis. The swollen cells rupture, the cell-membranes fuse together and form a reticulum in the spaces of which the fluid collects. The spaces do not communicate with one another, so that pricking the vesicle allows the fluid to escape only from those spaces which were opened by the needle. The contents of the vesicle are at first clear; later they become cloudy and opaque from the admixture with the cells which also come from the vessels. The fluid increases in amount, so that the partitions between the small spaces rupture, and one or several large spaces are formed. In the fluid there is also considerable detritus coming from fragments of broken-down cells and nuclei. A perpendicular section through a typical vesicle shows it to be fan-shaped, the handle of the fan being directed downward. In the milder forms of the eruption the changes are confined to the epidermis, and do not extend to the true skin beneath, being separated from this by one or several layers of comparatively intact cells. In more severe forms the degeneration involves the upper corium as well, and the papillæ are destroyed. In such cases cicatrices always remain. Healing takes place by the removal of the fluid parts of the exudation by evaporation, absorption, or rupture. The cell and tissue debris remain as a granular mass. New epithelial cells are formed beneath the lesion, and a new horny layer arises, enclosing the remains of the pustule between this and the old horny layer.

In the mucous membrane such typical lesions are never formed as in the skin. The exudation is not confined by a firm horny layer, and the cells are more permeable to fluid. The affected cells and the exudation are cast off, and a superficial ulcer is formed instead of a pustule.

In addition to these lesions of the skin, which constitute the pathognomonic anatomical lesions of the disease, various conditions are found in the blood and in the internal organs. Certain of these are peculiar to smallpox, but most of them are similar to changes found in other infectious diseases. Of the internal organs, the testicles and the bone-marrow show lesions which are peculiar to the disease. In the testicle small foci of necrosis with interstitial cellular infiltration are found. The foci may be so small as to be invisible to the naked eye, or may be one half cubic centimetre in diameter. They are single or multiple, and are found with as great frequency in the undeveloped testicles of children as in adults. The number and size of the foci in the testicle are in relation to the severity of the disease. Very similar lesions to those in the testicle are found in the ovaries, but are not so common. In the bone-marrow the specific lesions consist in the presence of foci of large pale cells resembling epithelium around and between the fat cells. There is a high degree of degeneration in the large glands of the body, such as the liver and kidney, but this is not peculiar to smallpox, nor is the character of the degeneration different from that found in other infections. The degeneration is always greatest in the severest cases, and reaches its maximum in the purpuric forms. Some degree of involvement of the lungs is almost always found at autopsies. The most common conditions are bronchitis and bronchopneumonia. This is due to infection by means of the bronchi. Lobar pneumonia is rare, as is also definite nephritis arising in the course of the disease. Nephritis as a sequence of the disease is not rare. No changes are found in the nerves, and none in the central nervous system. In most of the infectious diseases an increase in leucocytes of the blood is found. In smallpox the increase is in the mononuclear elements of the lymphoid type, and there is a marked decrease in the polynuclear leucocytes. These are reduced from 80 per cent of all leucocytes to 20 per cent, or even less. The decrease is not relative, but absolute. It is accounted for by the withdrawal of the cells from the blood by emigration in the lesions on the lungs and elsewhere, but chiefly by the inhibition which is placed on their renewal. Great numbers of the mononuclear lymphoid cells are formed in the lymph-nodes, spleen, and bone-marrow, and from these organs they find their way into the blood. The bone-marrow, in which the polynuclear cells are chiefly formed, shows a complete absence of these cells; also of cells which represent stages preceding their formation.

The results of recent investigations have led to the recognition in the specific skin-lesions of certain bodies which are to be regarded as protozoans, and are believed to be the cause of the disease. These bodies were first discovered by Guanieri in 1891, but their development has only recently been followed out. They appear first in the lower cells of the epidermis, and in connection with the earliest changes in the skin. The degeneration of the cells is more marked in the cells above, which do not contain the parasites. In their first recognizable form the bodies are from one half to one mm. in diameter and show no internal structure. They always occur in clear vacuoles in the cell adjoining the nucleus. Usually only one, but sometimes two, are found in a single cell, but they may be found between cells. These bodies increase in size and differentiation of structure appears, there being small points lying in clear spaces. These small points are probably of the nature of nuclear material. The bodies increase in size up to eight or nine mm., the cell-vacuoles containing them gradually enlarging. After attaining full growth, the bodies break up into a number of minute forms similar to those which first appear in the cells.

Digitized by Google

These new bodies enter into other epithelial cells, and the same development takes place The lesion seems to start in one or very few epithelial cells, and extends by continuous infection of adjoining cells by germs produced by multiplication. This is a distinct cycle of development, which corresponds to the multiplicative cycle of other protozoans, and consumes about 48 hours in its completion. It also corresponds to the developmental cycle of the malarial parasite within its human host.

If a very early lesion of the skin be examined, only the forms of parasites within the epithelial cells will be found. If the lesion is older, a different series of forms, representing a further and different development, will be found. The two forms are never found alongside of one another. The first form seems to require for its development a position in cells which are normal, and constantly enters new cells. The other form of development takes place in cells which have received some degree of injury from the primary development. In the second cycle of development some of the small bodies which result from the primary segmentation, instead of entering into new cells pass into the nuclei. Here they appear as small vesicles with a sharp rim and unstained contents. They undergo a differentiation into male and female forms, the various stages of which have not been made out, and give rise to small bodies which conjugate. From this conjugation a body is formed which consists of a large central chamber with a series of small chambers arranged around it. The development always begins within the nucleus; later the nucleus may completely degenerate, or the nuclear membrane may rupture, setting the body free. Within the small chambers spore-like bodies, with refractive contents and a small dot on one side, develop. These are from 0.37 to 0.50 in diameter and constitute the infectious material of smallpox. (See Plate.)

Just how infection takes place is unknown. The hypothesis which has most adherents is, that the virus lodges in the mucous membrane of the respiratory tract of the susceptible individual and there produces a lesion similar to that which takes place in the skin. In this the parasite undergoes development and increase. This development takes place during the period of incubation, and consumes 12 days. At this time the parasites which have developed in the primary lesion enter into the blood and produce the fever. From the blood they are carried to the various tissues of the body, and only find suitable conditions for their development in the epithelial cells of the skin. In these the parasites develop abundantly, and at the end of a certain period immunity is established and the disease is at an end. The parasite of smallpox is a sporozoon, and probably will be classed with the *Microsporidia*, although there are no species which are identical with it in morphology and development. But little is known of the development of the *Microsporidia*, and more must be known as to the development of the *Cytoryctes variolæ* before it will be possible to classify it accurately. There can be little doubt that it is to be regarded as the essential cause of the disease. That it is a living organism is shown by its development and by analogies with other living things. That it is the cause of the disease is shown by its presence in the lesions of smallpox and nowhere else, and the fact that it enters as a parasite into normal cells and in its further development produces degeneration. It is also possible from what is known of the parasite to give an explanation of the relation between smallpox and vaccinia. It may now be regarded as definitely established that vaccinia is a form of smallpox, the virus of which has been modified by growing in the tissues of a calf. True vaccinia leading to the production of a typical vaccine virus has been produced by inoculating cattle with smallpox virus. The latest investigations on smallpox and vaccinia seem to show the relation between the two to be very close. In vaccinia the same parasite is found in the same situation in the epithelial cells as in smallpox. The development is the same up to a certain point, but the intranuclear development which gives the complete sexual cycle in smallpox does not take place in vaccinia. In vaccinia the development of the parasite is not perfect. Forms appear corresponding only to the forms of the malarial parasite within the human host. The full development of both cycles in smallpox corresponds to the development of the malarial parasite within the host and within the mosquito. The monkey is the only animal known to be susceptible to smallpox. If it be inoculated with smallpox, both cycles of the organism appear. If a calf be inoculated, only the partial development takes place. It is remarkable that, when this partial development of the parasite is established by continuous inoculations in animals incapable of giving the suitable conditions for full development, the partial development is continued even when the parasite is transferred to a favorable soil such as is provided by the tissues of man and the monkey. Although the *Cytoryctes variolæ* must be regarded as the essential cause of the disease, there are other adjuvant causes which are of great importance. These are the bacteria. Bacteria are universally found in the pustules of the skin, and in the tissues, so that an invasion of the body with these must be assumed in every case of the disease. This secondary invasion is often of more importance in determining the fatal result of the disease than the primary infection by the cytoryctes. The invasion of bacteria seems to take place from the lesions in the mucous membranes. This is due to two conditions: first, to the lesion produced by the smallpox parasite, giving an opportunity for the bacteria, which are constantly present in the mucous membranes, to extend into the tissues; second, to the reduction of the resistance of the tissues to the growth and effects produced by bacteria. The same thing is true to a less extent in the other exanthemata, such as scarlet fever and measles. In these diseases a fatal termination is rarely due to the action of the specific organism of the disease, but usually to a secondary invasion of bacteria rendered possible by the specific lesions. See TOXINS AND ANTI-TOXINS; VACCINATION.

Consult: 'Journal of Medical Research,' Vol. XI., No. 5, 1904; 'Contributions to Ætiology and Pathology of Smallpox,' containing a full bibliography; Huguenin, 'Pocken'; Lubarsch and Ostertag, 'Ergebnisse der Pathologie und Anatomie' (1897).

W. T. COUNCILMAN, M.D.,
Harvard University Medical School.

Digitized by Google

Smalls, smâlz, **Robert**, American legislator, formerly a slave: b. Beaufort, S. C., 5 April 1839. He received a limited education, and in the capacity of pilot rendered valuable service to the Union cause during the Civil War, and was promoted to the rank of captain therefor. During the years immediately following the war he rose to prominence in the Republican party, and became a member of the South Carolina legislature. He afterward served six terms in the National Congress. He was successively appointed collector of the port of Beaufort, S. C., from 1898.

Small'wood, William, American soldier: b. Kent County, Md., 1732; d. Prince George County, Md., 14 Feb. 1792. He raised a battalion of Maryland troops in 1776, was elected colonel, and on 10 July 1776 joined Washington. On 20 August his troops were engaged at the battle of Long Island and bore the brunt of the battle from sunrise until the close of the battle, leaving half their number on the field. At White Plains on 18 October they were again in the thickest of the battle. Smallwood was promoted brigadier-general for his gallantry, was engaged at Fort Washington on 16 November, his command again bearing heavy losses, and in 1777 accompanied General Sullivan on his Staten Island expedition. He raised a new battalion of Maryland troops in that year and at the battle of Germantown, 4 Oct. 1777, his command retrieved the day and captured part of the enemy's camp. He was stationed at Wilmington in the winter of 1777–8, captured a British brig laden with provisions, and served with Gates in his southern campaign. He won the thanks of Congress for conduct at the battle of Camden, and was appointed major-general in 1780, but refused to serve under Baron Steuben, though he remained in the army until 1783. He was elected to Congress in 1785 and in 1785–8 was governor of Maryland.

Smalt. See COBALT.

Smaltite, "gray cobalt", "tin-white cobalt", the chief ore of cobalt, is a tin-white to steel-gray, metallic mineral. Essentially it is cobalt diarsenide, $CoAs_2$, but nickel is usually present and as its percentage increases the mineral graduates into chloanthite, the isomorphous nickel diarsenide. It also generally contains iron and a small amount of sulphur. It is usually massive, but crystallizes in the isometric system, the crystals showing distinct octahedral cleavage. As the orthorhombic mineral, safflorite, has the same composition, smaltite is one of the few illustrations of an isodimorphous mineral. Its hardness is 5.5 to 6; specific gravity 6.2 to 6.5; the massive mineral is thus distinguished from the softer and much heavier safflorite. Its color is tin-white to steel-gray; streak grayish-black; lustre metallic; opaque. It is easily fused to a magnetic globule which affords reactions with borax beads, for iron, cobalt and nickel. Its most noteworthy occurrences are in the silver and copper mines of Saxony, Bohemia and England.

Smart, Christopher, English poet: b. Shipbourne, Kent, 11 April 1722; d. London 17 May 1771. He was graduated from Cambridge in 1742, but remained there as fellow of Pembroke until 1747. His early fame as a satirist was supplemented by the accomplishment of more serious work, the most noted of which was his translation of Horace in 1756. His first volume of poems appeared in 1752, but it was not until a half century after his death that he won the distinction for original work in the larger world of letters which still attaches to his name. His 'Song to David,' published in 1763, and written, it is said, upon the walls of his cell during his confinement for debt in a house of detention for such offenders, was at first deemed odd and melancholy. In 1820 it was reprinted in the London 'Magazine,' and hailed by Rossetti and others as the greatest poem of the 18th century. Consult Browning, 'Parleyings with Certain People of Importance.'

Smart, Helen Hamilton Gardener, American novelist: b. Winchester, Va., 21 Jan. 1858. She was graduated from the Cincinnati High and Normal Schools, made a special study of biology and medicine in New York, is an authority on heredity and an able advocate of ethical and social reform. She was married to Colonel S. A. Day (retired), in 1901. She has published: 'Men, Women, and Gods' (1885); 'A Thoughtless Yes' (1890); 'Pray You, Sir, Whose Daughter?' (1892); 'Is This Your Son, My Lord?' (1895); 'An Unofficial Patriot' (1898); 'Historical Sketches of Our Navy'; etc.

Smart, Henry, English organist and composer: b. London 26 Oct. 1813; d. there 6 July 1879. He was educated for the law, but turned his attention to music, became organist of the parish church at Blackburn in 1831, and while there composed his first important work, an anthem. He removed to London in 1836 where he engaged as an organist, teacher, and composer. Among his compositions are: An opera, 'Bertha' (1855); the cantatas, 'The Bride of Dunkerron' (1864); 'King René's Daughter' (1871); 'The Fisher Maidens'; 'Jacob,' an oratorio.

Smart, William, Scotch political economist: b. Renfrewshire 10 April 1853. He was graduated from the University of Glasgow, and entered upon a business career. In 1884 he began to write upon economic subjects, and two years later received a lectureship at the College of Dundee. Since 1896 he has held the Adam Smith professorship at the University of Glasgow, and is more widely known as the English translator of Bohm-Bawerk's 'Positive Theory of Capital' (1891), and as the editor of Wieser's 'Natural Value' (1893). He is the author of: 'Studies in Economics' (1895); 'The Distribution of Income' (1899); and 'Taxation of Land Values and the Single Tax' (1900).

Smart-weed, or **Water-pepper**, a glabrate, annual herb (*Polygonum hydropiper*), of the buckwheat family, naturalized from Europe, and found in wet places. It has alternate, lanceolate leaves, with cylindric fringed ochreæ, and panicled racemes of small flowers with greenish calyx. It also has a juice which is not only acrid to the taste, but will inflame tender skin, and has diuretic, and, possibly, other medicinal properties.

Smartas, smär'taz. See HINDU.

Smeaton, smē'tŏn, **John**, English civil engineer: b. Austhorpe, near Leeds, Yorkshire, 8 June 1724; d. there 28 Oct. 1792. His father was an attorney, and being desirous to bring up his son to the same profession, he took him to

Digitized by Google

London in 1742, where he attended the courts in Westminster Hall; but after discovering his son's disinclination to the profession he yielded to the desire for a different career. In 1751 Smeaton began a course of experiments on a machine of his own invention, to measure a ship's way at sea, and made two voyages with Dr. Knight to try the effect of it, and also for the purpose of making experiments on a compass of his own construction, which was rendered magnetical by Dr. Knight's artificial magnet. In 1753 he was elected a fellow of the Royal Society. In 1755 the Eddystone lighthouse was burned down, and Smeaton was entrusted with the task of rebuilding it. Operations were commenced in August 1756, and completed in October 1759. It stood till 1882, when it was replaced by a new structure. In the year in which the lighthouse was finished he was awarded the Copley medal of the Royal Society. After this Smeaton was employed on many works of great public utility. He made the river Calder (in Yorkshire) navigable; planned and executed the Forth and Clyde Canal in Scotland, constituting a waterway for traffic passing between the Atlantic and the German Ocean. He was appointed engineer to Ramsgate harbor, and improved it by various operations, of which he published an account in 1791. He built a steam-engine at Austhorpe, and made experiments with it to ascertain the power of Newcomen's engine, which he brought to a greater degree of perfection, both in its construction and powers. During many years of his life he was a frequent attendant upon Parliament, his opinion on various works begun or projected being continually called for. Smeaton spent much of his leisure in the study of astronomy, for which purpose he fitted up an observatory in his house. Consult his 'Reports' (1797); Smiles, 'Lives of the Engineers' (1861).

Smeaton, William Henry Oliphant, Scottish editor and author, distant relative of John Smeaton (q.v): b. Aberdeen 24 Oct. 1856. He was educated at the University of Edinburgh and in 1878 went to New Zealand where he was principal of the Whangarei High School in 1881–3. He then went to Melbourne where he was engaged on the editorial staff of the 'Daily Telegraph' for some time and in 1888–93 he was editor of the 'Daily Northern Argus,' Queensland. He then returned to England where he has since engaged in literary work. He is joint-editor of the 'Famous Scots Series,' and other works, and has written: 'By Adverse Winds' (1895); 'Memorable Edinburgh Houses' (1898); 'The Medice and the Italian Renaissance' (1901); 'Scots Essayists from Stirling to Stevenson' (1902); etc.

Smed'ley, William Thomas, American painter: b. Chester County, Pa., 26 March 1858. He was taught engraving in Philadelphia and painting in the Pennsylvania Academy of Fine Arts. He subsequently studied in New York and in Paris under Jean Paul Laurens. Opening a studio in New York in 1880 he became much sought after as an illustrator of books and periodicals. In 1882 he traveled with the Marquis of Lorne through Western and Northwest Canada to obtain drawings for illustrating 'Picturesque Canada.' He made a sketching tour round the world in 1890. His work is distinguished by remarkable purity of line, delicacy, and power of dramatic expression. Among his oil paintings may be mentioned 'An Indiscreet Question'; 'A Thanksgiving Dinner'; and 'A Summer Occupation.'

Smell. See SENSES.

Smellie, smĕl'ĭ, **William,** Scottish author and naturalist: b. Edinburgh 1740; d. there 24 June 1795. His earliest important work was the compiling of a large part of the first edition of the 'Encyclopædia Britannica,' published in 1771. Six years earlier he had gained some prominence in the field of natural history by a 'Dissertation on the Sexes in Plants,' in which he opposed the teachings of Linnæus, and in 1780 he published the first part of his translations of Buffon's 'Natural History.' In 1790 his own contributions to the subject were edited and published under the title: 'Philosophy of Natural History.' He was also the author of many other works, among them were biographies of Hume, Adam Smith and other prominent Englishmen.

Smelt, a genus (*Osmerus*) of fishes of the family *Argentinidæ* and closely related to the *Salmonidæ*. The body is slender, and somewhat compressed; the eyes large and round, and the under jaw projecting. The American smelt (*O. mordax*) is 10 to 11 inches long; the head and body are semi-transparent, with the most brilliant tints of green, and silvery. It has a strong odor, by many compared to that of violets. It inhabits the seacoast from the Gulf of Saint Lawrence to Virginia as well as the depths of those lakes, such as Champlain and Memphremagog, which have a sandy bottom, and in the winter and early spring ascends rivers in great multitudes, for the purpose of depositing its spawn. It is highly esteemed as food owing to its delicate flavor. The smelt fishery is one of considerable and growing importance and is prosecuted by means of nets and lines during the winter months. Some of the land-locked varieties in the lakes of Maine are said even to excel the marine fish in flavor. The European smelt (*O. eperlanus*) is scarcely distinguishable from ours and is the object of an important fishery. The surf smelt (*Hypomesus pretiosus*) is a related fish about a foot in length, found abundantly on the coast of California and Oregon and is said to be deliciously flavored. A species of cisco or whitefish (*Argyrosomus osmeriformis*) found in the lakes of central New York, is there known as the smelt, which fish it resembles superficially in form and size.

Smelting. See BLAST FURNACE.

Smerdis, smẽr'dĭs, the Greek name of the brother of Cambyses, king of Persia. In Persian inscriptions he is known as Bardija. He incurred the envy of Cambyses who was warned in a dream that Smerdis should take from him the throne and was, by the king's command, secretly assassinated. His name was taken by one of the Magi, Gaumata, who won the favor of the people and occupied the throne for seven months. Gaumata in 521 B.C. was recognized by Darius as an impostor and usurper and consequently put to death.

Smet, Peter John de. See DE SMET, PETER JOHN.

Digitized by Google

Smetana, smĕ-tä'nä, **Frederick,** Bohemian composer: b. Leitomischl, Bohemia, 2 March 1824; d. Prague 12 May 1884. He was a well-known orchestral leader in Austria and Sweden, and was the composer of numerous symphonies and other operatic works. Among them are: 'Die Brandenburger in Böhmen' (1866); 'Richard III.'; 'Mein Vaterland'; 'Triumph-symphonie' (1853).

Smethwick, smeth'ĭk, England, in Staffordshire, northwest of and near Birmingham, is an industrial town, with engineering and machine shops, rivet, screw and tube works, chemical and glass-works, iron foundries, etc. Pop. about 58,000.

Smilax, a liliaceous genus, with entire or lobed leaves, often coriaceous and shining, and greenish, diœcious, 6-merous flowers with recurved perianth. The pedicels are gathered in axillary umbels, on long peduncles, and bear red, purple or black berries. They have stout, long, tuberous rootstocks, and woody or herbaceous stems that are usually twining and often climbing by tendrils, which are two stipules arising from the sheaths of the petioles. *S. pseudo-clima, S. rotundifolia* and others, are the familiar green or cat-briers, that twist themselves into impenetrable thickets, and are, moreover, well armed with vicious, strong prickles; they are interesting in winter, however, on account of their long-lingering leaves and bunches of berries. The American carrion-flower (*S. herbacea*) has an annual stem, that is very artistic in young growth, but the tassels of bloom when open in early spring, have an insupportable putrid odor. The rootstocks furnish medicines in several countries; those of several South American species yield china root and sarsaparilla (q.v.).

The smilax used for decoration by florists is an entirely different plant (*Myrsiphyllum asparagoides*) raised under glass.

Smiles, Samuel, Scottish writer: b. Haddington, 23 Dec. 1812; d. London 17 April 1904. He was educated for the medical profession and practised for some years as a surgeon at Leeds, when he became editor of the 'Leeds Times.' In 1845 he became secretary to the Leeds and Thirsk Railway, and in 1854 to the South-Eastern Railway, from which post he retired in 1866. He is the author of many works on industrial enterprise, and other themes, the chief of which are: 'Life of George Stephenson' (1857); 'Self-Help' (1859); which attained a very wide circulation and is the work by which he is best known; 'Workmen's Earnings, Strikes and Wages' (1861); 'Lives of the Engineers' (1861 and 1875); 'Industrial Biography' (1863); 'Lives of Boulton and Watt' (1865); 'The Huguenots, their Settlements, Churches, and Industries in England and Ireland' (1867); 'Character' (1871); 'The Huguenots in France after the Revocation of the Edict of Nantes' (1874); 'Thrift' (1875); 'Lives of Thomas Edward' (1876); 'Robert Dick' (1878); 'George Moore, Merchant and Philanthropist' (1878); 'Self-Effort' (1889); 'Jasmin, the Barber-Poet' (1891); and 'Josiah Wedgwood' (1894).

Smiley, smī'lĭ, **Sarah Frances,** American author: b. Vassalborough, Maine, 30 March 1830. She is well known as a religious speaker and writer, is a Biblical scholar and linguist, and is the founder and director of the Society for Home Study of the Holy Scriptures and Church History. She has published: 'Who is He?' (1868); 'Fulness of Blessing' (1876); 'Garden Graith' (1880); etc.

Smillie, smī'lĭ, **George Henry,** American painter: b. New York 29 Dec. 1840. He traveled and studied his profession in Europe and America and many of his works, chiefly landscapes, are to be seen in public and private galleries, American and European. He is a member of the American Water Color Society, in which he had held the office of secretary, and since 1882 has been National Academician.

Smillie, James D., American painter: b. New York 16 Jan. 1833. Before becoming a painter he made his reputation as a landscape engraver. He is one of the founders of the American Water Color Society and one of the "original fellows" of the Painter-Etcher Society of London, England. Since 1876 he has been a National Academician. He is well known for his writings on etching and is President of the New York Etching Club.

Smirke, smėrk, **Robert,** English painter: b. near Carlisle in 1751; d. London 5 Jan. 1845. He was originally employed in painting coach panels, but soon proved himself capable of excelling in a much higher branch of the art; and before the appearance of Wilkie had no great rival as a genre painter. He was elected a member of the Royal Academy in 1792, the year when Sir Joshua Reynolds died, and gave as his presentation picture Don Quixote and Sancho. A large proportion of his pictures are admirable illustrations of the creation of Cervantes' pen. Among others may be mentioned Sancho's Audience of the Duchess, Don Quixote addressing his Princess Dulcinea, and the Combat between Don Quixote and the Giants interrupted by the Innkeeper. Among his other works a first place is due to his Infant Bacchus, Psyche, the Angel Justifying Providence, from Parnell's Hermit; the Gipsy, and the Fortune-tellers.

Smith, Adam, Scottish economist and philosopher: b. Kirkcaldy, Fifeshire, 5 June 1723; d. Edinburgh 17 July 1790. He studied at the University of Glasgow, where he remained until 1740, when he went to Balliol College, Oxford. Quitting Oxford, and all views to the church, which had led him there, in 1748 he settled at Edinburgh, and delivered some courses of lectures on rhetoric and polite literature. In 1751 he was elected professor of logic at Glasgow, and the year following, of moral philosophy at the same university. Both in matter and manner his lectures were of the highest merit. Those on moral philosophy contained the rudiments of two of his most celebrated publications, of which the first, the 'Theory of Moral Sentiments,' appeared in 1759, and was most favorably received. His theory makes sympathy the foundation of all our moral sentiments. To this work he afterward added an 'Essay on the Origin of Languages'; and the elegance and acuteness displayed in these treatises introduced him to the notice of several eminent persons, and he was engaged in 1764 to attend the Duke of Buccleuch in his travels. A long residence in France with this nobleman introduced him to the acquaintance of Turgot, Quesnay, Necker, D'Alembert, Helvetius, and Marmontel, to sev-

Digitized by Google

eral of whom he was recommended by David Hume. He returned to Scotland in 1766, and at Kirkcaldy led a life of strict study and retirement for ten years, the fruit of which was his celebrated 'Inquiry into the Nature and Causes of the Wealth of Nations' (1776). This work has become a standard classic, and may be deemed the formal precursor of the modern sciences of political economy. (See POLITICAL ECONOMY.) It owed something to French thinkers, but arranged the ideas derived from them in an original fashion. Its basic contention is that national progress is best secured by freedom of private initiative within the bounds of justice. Subsequently he was made commissioner of customs for Scotland, and in 1787 was chosen rector of the University of Glasgow. A short time before his death he ordered all his manuscripts to be burned, except a few detached essays. Numerous editions both of the 'Moral Sentiments' and the 'Wealth of Nations' have been published. Of the former the 6th edition contained considerable additions and corrections. This work was translated into French by the Marquis de Condorcet. A volume of additions and corrections to the first two editions of the 'Wealth of Nations' appeared in 1784, and was included in the 3d edition, published the same year. The best of the later editions of this standard work are those published under the editorship of Macculloch (with life, notes, and supplementary dissertations, 1828; often reissued), Thorold Rogers (1870), J. S. Nicholson (1884), and Belfort Bax (1887). The 'Wealth of Nations' has been translated into several European languages — into French by Germain Garnier (1802; new ed., 1860); into German by Garve (1794–6) and by Asher (Stuttgart 1861). Consult: Stewart, 'Life of Adam Smith' (4th ed., 1843); Mackintosh, 'Progress of Ethical Philosophy' (in Vol. I. of his 'Misc. Works' 1854); Rae, 'Life of Adam Smith' (1895); Graham, 'Scottish Men of Letters in the 18th Century' (1901).

Smith, Albert, English humorist: b. Churtsey, Surrey, 24 May 1816; d. London 22 May 1860. He was educated as a surgeon, but did not long practise that profession. His career in the realm of light literature began with the writing of numerous burlesques. Among them were: 'The Scattergood Family'; 'Christopher Tadpole'; 'The Natural History of the Ballet Girl'; 'Stuck-up People, etc.' In 1849 he originated his popular pictorial entertainments, humorous descriptions of his travels upon the continent and in oriental countries, which brought him substantial returns.

Smith, Alexander, Scottish poet and essayist: b. Kilmarnock 31 Dec. 1830; d. Wardie, near Granton, 5 Jan. 1867. After a general education, he learned pattern-designing, and removed to Glasgow with the double object of finding employment among its manufacturers and intellectual improvement among its literary society. In 1853 he published his 'Life Drama.' It was at first enthusiastically received as a poem of the highest order, but a reaction of dissent soon set in headed by Aytoun, who in his burlesque tragedy of 'Firmilian' characterized Smith's production as belonging to the "spasmodic" school with Dobell and P. J. Bailey. In 1854 Smith was appointed secretary of the University of Edinburgh, to which the offices of registrar and secretary to the university council were later added, and the following year produced, with Sydney Dobell, a volume of 'Sonnets on the War.' This was followed in 1857 by his 'City Poems,' to which succeeded his longest and best work, 'Edwin of Deira' (1861). He now seems to have turned his attention seriously to prose composition. He became an active contributor to 'Blackwood's' and 'Macmillan's' magazines, the 'North British Review,' 'Good Words,' and other periodicals. In 1863 he published a collection of papers entitled 'Dreamthorp,' succeeded by 'A Summer in Skye' (1865) and 'Alfred Hagart's Household' (1865). 'Edwin of Deira,' obscured by the 'Idylls of the King,' has undeservedly been neglected.

Smith, Alexander Coke, American Methodist bishop: b. Sumter County, S. C., 16 Sept. 1849; d. Asheville, N. C., 28 Dec. 1906. He was graduated from Wofford College, Spartanburg, S. C., in 1886, was appointed professor of mental and moral philosophy there, and in 1890 was called to the chair of theology at Vanderbilt University. He was elected bishop of the Methodist Episcopal Church South in May 1902.

Smith, Andrew Jackson, American army officer: b. Bucks County, Pa., 28 April 1815; d. Saint Louis, Mo., 30 Jan. 1897. He was graduated from the United States Military Academy in 1838, and prior to the Civil War was stationed at various army posts on the Western frontier. In 1861 he was promoted to the rank of colonel in command of the 2d California Cavalry, and in 1862 brigadier-general of volunteers and chief of cavalry of the Department of the Missouri. He took part in the siege of Corinth and was also engaged in the campaigns of Vicksburg and Mobile. In 1866 he was restored to the rank of colonel in the regular army, but three years later resigned, and accepted the appointment of postmaster of Saint Louis. Ten years later he was again made an officer in the United States army, and placed upon the retired list.

Smith, Arthur Donaldson, American explorer: b. Philadelphia 1864. He was graduated from the medical department of the University of Pennsylvania, and afterward studied abroad. He has traveled extensively into the African interior, where he obtained valuable information regarding Somaliland. He has written an account of his discoveries entitled: 'Through Unknown African Countries.'

Smith, Benjamin Bosworth, American Protestant Episcopal bishop: b. Bristol, L. I., 13 June 1794; d. New York 31 May 1884. He was graduated from Brown University in 1816, took orders in 1818, and in 1820–3 had charge of various churches in Virginia. He was rector of Saint Stephen's Church, Middlebury, Vt., in 1823–8, and from 1830 to 1837 rector of Christ Church, Lexington, Ky. He was consecrated first bishop of Kentucky in 1832 and on the death of Bishop Hopkins in 1868 he became presiding bishop of the Episcopal Church in the United States. He published: 'Saturday Evening, or Thoughts on the Progress of the Plan of Salvation' (1876); 'Apostolic Succession' (1877); etc.

Digitized by Google

Smith, Benjamin Eli, American editor: b. Beirut, Syria, 7 Feb. 1857. He was graduated from Amherst College in 1877, and has been editor of the 'Century Dictionary'; 'Century Cyclopedia of Names'; and 'Century Atlas.' He has translated Schwegler's 'History of Philosophy' (1879); Cicero's 'De Amicitia,' Lælius (1897); and edited Franklin's 'Poor Richard's Almanac' (1898); and other works.

Smith, Benjamin Leigh, English Arctic explorer: b. 12 March 1828. He was educated at Cambridge and was called to the bar in 1856. After acquiring a fortune he became interested in Arctic exploration and made his first voyage in the yacht Samson in 1871, returning with important acquisition of facts regarding Spitzbergen, where he had penetrated to lat. 81° 24′. He made a second and third expedition to Spitzbergen in 1872–3. By his deep-sea observations he established the fact of warm under-currents flowing beneath the surface water of the Gulf Stream. In 1880–1 on the steamer Eira he made two trips, the first resulting in important discoveries on and in the neighborhood of Franz-Josef Land. On the second expedition, the Eira was crushed in the ice and sunk 21 Aug. 1881 off Cape Flora. After wintering in that region the crew reached Nova Zembla in August 1882 and were brought home by a relief expedition. He received gold medals from the Paris Geographical Society in 1880 and from the Royal Geographical Society in 1881.

Smith, Buckingham, American historian and philologist: b. Cumberland Island, Ga., 31 Oct. 1810; d. New York 5 Jan. 1891. He was graduated from the Harvard Law School in 1836, and for several years practised in the courts of Maine, when he took up his residence in Florida. His knowledge of the Mexican language and collections of Indian manuscripts and other relics were acquired during his office as secretary of the United States legation in Mexico in 1850–2. In 1855–8 he served in a similar capacity the legation at Madrid, and there gathered material of much value regarding the history of the Spanish-American colonies. Among his most important works are: 'Narrative of Hernando de Soto' (1854); 'A Grammatical Sketch of the Heve Language' (1861); 'A Grammar of the Pima or Nerome' (1862); 'An Enquiry into the Authenticity of Documents Concerning the Discovery of North America by Verrazzano' (1864).

Smith, Charles Emory, American journalist: b. Mansfield, Conn., Feb. 1842; d. Philadelphia, Pa., Jan. 1908. He was graduated from Union College in 1861, and five years later became the editor of the Albany *Express*. His connection with the Philadelphia *Press* dates from 1880, when he was made its editor-in-chief. This office he resigned in 1890 to become minister to Russia. In 1898 he was appointed postmaster-general of the United States and continued in the cabinet until 1901, when he resigned. In 1902 he again assumed the editorship of the Philadelphia *Press*.

Smith, Charles Ferguson, American soldier: b. Philadelphia, Pa., 24 April 1807; d. Savannah, Tenn., 25 April 1862. He was graduated at West Point in 1825 and served there as instructor in tactics and as adjutant and commandant 1829–45. He commanded a light battalion in the Mexican War and won distinction in several actions. He subsequently commanded the Red River expedition, served in the Utah expedition, and at the commencement of the Civil War was made brigadier-general of volunteers in the Union army. In 1862 he was active in the battle of Fort Donelson and was promoted to major-general of volunteers.

Smith, Charles Henry, «Bill Arp», American humorist: b. Lawrenceville, Ga., 15 June 1826; d. Atlanta, Ga., 24 Aug. 1903. He was graduated at Franklin College, Ga., 1848, practised law, first at Rome, Ga., and then at Cartersville, and served in the Confederate army throughout the Civil War, becoming major on the staff of the 3d Georgia Brigade. He was a State senator 1866–8, and was well known as the author of the «Bill Arp» letters, contributed to the Atlanta *Constitution* and to 'Home and Farm' of Louisville, Ky. He published: 'Bill Arp's Letters' (1886); 'Bill Arp's Scrap Book'; 'A Side Show of the Southern Side of the War'; 'Fireside Sketches' (1890); 'Georgia as Colony and State, 1733–1893' (1890); 'The Uncivil War from 1861 to Date.'

Smith, Charles Sprague, American educator, lecturer, and author: b. Andover, Mass., 27 April 1853; d. 29 March, 1910. He was educated at Amherst and in Europe and was professor of modern languages and foreign literature at Columbia University 1880-91. He has been a lecturer since 1887. He is the author of 'Barbizon Days' (1902).

Smith, David, American naval officer: b. Scotland 1834; d. Washington, D. C., 29 May 1903. Having been brought to America in childhood, he received his education at the Andover Academy, and at Harvard University. Just before the outbreak of the Civil War he entered the engineer corps of the United States navy and took part in many of its later operations. He originated the idea of ventilating warships by the exhaust method, but was more widely known for his invention of an apparatus for testing instruments of precision used in engineering. He was promoted rear-admiral and retired in 1896, but took part in the Cuban war.

Smith, David M., American inventor: b. Hartland, Vt., 1809; d. Springfield, Vt., 10 Nov. 1881. His first patent was secured in 1832, and he began the manufacture of «awls on the haft.» This awl haft was similar to the one now known as the Aiken awl. He removed to Springfield after representing the town of Gilsum in the New Hampshire legislature for 1840–1. In 1849 he patented in America and England a combination lock that could not be picked. Among his other patents were an improvement on the first iron lathe dog, a pig-splitting machine, two sewing machines, a patent clothes-pin, a spring hook and eye, and a blanket hook. In all he secured about 60 patents, including the machinery now in use for folding newspapers. His inventions also included the machinery by which his patents were made.

Smith, Edmund Kirby, American soldier: b. Saint Augustine, Fla., 16 May 1824; d. Sewanee, Tenn., 28 March 1893. He was graduated at West Point in 1845, and entered the Mexican campaign as 2d lieutenant in the 5th Infantry. He fought at Palo Alto, Resaca de la

Digitized by Google

Palma, and Monterey, was brevetted 1st lieutenant for bravery at Vera Cruz and Cerro Cordo, and captain for gallantry at Contreras. During 1849–52 he taught mathematics at West Point. In 1855 he was appointed captain in the 2d cavalry, and later engaged in Indian campaigns, reaching the rank of major. He resigned his commission when Florida seceded. In 1861 he was commissioned colonel in the Confederate army, and in the same year was made brigadier-general. Early in the war he served under General J. E. Johnston, and was severely wounded at Bull Run, 21 July 1861. In 1862, having been made major-general, he commanded the Confederate forces in the Cumberland Gap region, led the advance of Bragg's army in the Kentucky campaign, and on 30 August defeated the Federal troops under General Nelson near Richmond, Ky. His plan included an attack upon Cincinnati, but he withdrew toward Frankfort when Bragg failed to come to his support. He was raised to the rank of lieutenant-general, and took part in the battles of Perryville and Stone River (q.v.). In 1863 he was placed in command of the department west of the Mississippi, and organized the governments of Louisiana, Arkansas, Texas, and Indian Territory, and established a vigorous foreign trade by a successful running of the blockade at Galveston. In 1864 he operated against Banks in the Red River campaign, and he was the last Confederate general to surrender (26 May 1865). He was president of the Pacific and Atlantic Telegraph Company, 1866–8, president of the Western Military Academy 1868–70, chancellor of the University of Nashville 1870–5, and professor of mathematics in the University of the South, Sewanee, Tenn., from 1875 until his death.

Smith, Elizabeth Oakes (Prince), American author, wife of Seba Smith: b. near Portland, Maine, 12 Aug. 1806; d. Hollywood, S. C., 15 Nov. 1893. She was an occasional contributor to the press for nearly 50 years, and was one of the first women to speak upon the lecture platform, from which she advocated equal suffrage for women and other reforms. Her first volume of verse, collected from the periodicals, was published in 1838 under the title 'Riches Without Wings.' Her other books which had also a short-lived popularity, include: 'The Sinless Child and Other Poems' (1843); 'Stories for Children' (1847); 'Woman and Her Needs' (1851), and 'Jacob Feisler,' a drama (1853).

Smith, Erminnie Adelle Platt, American ethnologist: b. Marcellus, N. Y., 26 April 1836; d. Jersey City, N. J., 9 June 1886. She was educated at Willard Seminary in Troy, but continued her studies abroad some years later, and during a residence in Germany was graduated from the School of Mines at Freiburg. In 1878 she was engaged by the Smithsonian Institution to make a study of the languages and customs of the Iroquois Indians, and devoted the remainder of her life to the investigation of that subject. In order that she might gain the most intimate acquaintance with their customs and institutions she became a member of one of their tribes, the Tuscaroras, and in this way familiar with their legends and ideas and habits in general.

Smith, Francis Henney, American educator and soldier: b. Norfolk, Va., 18 Oct. 1812; d. Lexington, Va., 21 March 1890. He was graduated from West Point in 1833, and in 1834 was appointed assistant professor there, but resigned from the army in 1836, and was professor of mathematics at Hampden-Sidney College, Virginia, in 1837–9. On the organization of the Virginia Military Institute at Lexington, Va., in 1839, he was appointed superintendent, a position he occupied until January 1890, when he became professor emeritus. During the Civil War he served as colonel in the Confederate army, was in command of the fort at Craney Island, participated in the defense of Richmond in 1864, and of Lynchburg against General Hunter. After the war he at once set about the reconstruction of the institute buildings which had been destroyed by fire, and resumed his duties there when it was reopened. He published various text-books on mathematics and also wrote: 'The Best Methods of Conducting Common Schools' (1849); 'Report to the Legislature of Virginia on Scientific Education in Europe' (1859); etc.

Smith, Francis Hopkinson, American artist, author and engineer: b. Baltimore, Md., 23 Oct. 1838. Educated as a mechanical engineer, he became a contractor, and planned and supervised the building of numerous important works, among them the sea-wall around Governor's Island at Tompkinsville, S. I., the Race Rock lighthouse off New London, Conn., and the foundation for the Statue of Liberty on Bedloe's Island, New York harbor. But he is also an artist, particularly in water colors and charcoal, earning special praise for his aquarelle sketches of Venice from all viewpoints and under all conditions of atmosphere and light. Again, he is an author, best known for his genial 'Colonel Carter of Cartersville' (1891), which was dramatized by Augustus Thomas, and arranged by the author for his public readings. Other volumes by him are: 'A White Umbrella in Mexico' (1881); 'A Day at Laguerre's' (1892), 'Gondola Days' (1897); 'Venice of To-day' (1897); 'Caleb West' (1898); and 'The Fortunes of Oliver Horn' (1903); 'At Close Range' (1904); 'Kennedy Square' (1911).

Smith, Sir Francis Pettit, English inventor: b. Hythe, England, 9 Feb. 1808; d. South Kensington 12 Feb. 1874. From boyhood his interest in boats led him to invent many ingenious devices for their propulsion. In 1836, in entire ignorance of the inventions of Ericsson and Stevens, he constructed a model steamboat propelled by a screw below the water line. His patent for this method of propulsion was obtained six weeks before that of Ericsson. The British admiralty, in spite of the opposition of the engineering world, assisted in the experiments which resulted in the construction of a larger vessel whose trial trip in October 1839 assured the success of the new propeller and its adoption by the British navy in 1844, five years after Ericsson's construction of the first American steam warship. Consult: Woodcroft, 'Origin and Progress of Steam Navigation' (1848); Bourne, 'Treatise on the Screw Propeller.'

Smith, George Adam, Scottish theologian: b. Calcutta 19 Oct. 1856. He was educated in Edinburgh at the University and at New College, studied also in Tübingen and Leipsic, was minister of Queen's Cross Free Church in 1882-92, and in 1892 was made professor of Old Testament language, literature, and theology in the United Free Church College of Glasgow. In 1896 he visited the United States as Percy Turnbull lecturer on Hebrew poetry at the Johns Hopkins University, and in 1899 as Lyman Beecher lecturer at Yale University. His writings in book form are: 'The Book of Isaiah' (1888-90); 'The Preaching of the Old Testament to the Age' (1893); 'Historical Geography of the Holy Land' (1894; 7th ed. 1901); 'The Twelve Prophets' (1896-7); a 'Life of Henry Drummond' (1898; 6th ed. 1902); and 'Modern Criticism and the Preaching of the Old Testament' (1901).

Smith, George Barnett, English author: b. Ovenden, near Halifax, Yorkshire, 17 May 1841. In 1864, after a secondary schooling at Halifax, he went to London, where he was employed on the staff of the *Globe* and the *Echo*, published a book of verse in 1869, and became a contributor to the leading British reviews. Among his further volumes are: 'Poets and Novelists,' critiques (1875); 'Shelley' (1877); a 'Life of Bright' (1881); 'Victor Hugo' (1885); 'William I. and the German Empire' (1887); and a work on 'The United States' (1896-7). He is also an amateur etcher of some ability.

Smith, George Murray, English publisher: b. London 19 March 1824; d. Weybridge, Surrey, 6 April 1901. He entered the counting-house of his father, senior partner of the firm of Smith, Elder & Company, India merchants and publishers, became manager of the publishing department and after his father's death assumed control of the entire business, including banking and the agency of the Overland route to India. He published the works of Charlotte Brontë, Ruskin, Darwin, and Thackeray, founded the 'Cornhill Magazine' in 1859 with the latter as editor and contributor, published in it George Eliot's 'Romola' and in 1865 he founded the *Pall Mall Gazette* with Frederick Greenwood as editor. The banking business was ultimately transferred to other hands, Smith, Elder and Company retaining the publishing interests and continuing to issue the works of the leading English authors. They were publishers for Robert Browning and Matthew Arnold and were granted the privilege of publishing Queen Victoria's 'Leaves from the Journal of Our Life in the Highlands' and 'Early Years of the Prince Consort,' as well as Sir Theodore Martin's 'Life of the Prince Consort.' Perhaps the most notable achievement of Smith's life was the publication of the 'Dictionary of National Biography' (63 vols., 1885-1900) which was followed by a supplement (3 vols., 1901) to which is prefixed a memoir of the publisher's life by the editor, Sidney Lee.

Smith, George Williamson, American college president: b. Catskill, N. Y., 21 Nov. 1836. He was graduated from Hobart College in 1857, was principal of the Bladensburg Academy, Md., in 1858-9, and in 1861-4 was clerk of the United States navy department while studying theology. He was ordained to the Protestant Episcopal priesthood in 1864, was chaplain in the United States Navy in that year and in 1864-5 was acting professor of mathematics at the United States Naval Academy at Newport. He was chaplain at the Naval Academy at Annapolis in 1865-8, on the United States steamship Franklin in 1868-71, rector of Grace Church, Jamaica, Long Island, N. Y., in 1872-81, and of the Church of the Redeemer, Brooklyn, N. Y., in 1881-3. Since 1883 he has been president of Trinity College, Hartford, Conn.

Smith, Gerrit, American philanthropist, reformer and statesman: b. Utica, N. Y., 6 March 1797; d. New York 28 Dec. 1874. He was graduated from Hamilton College in 1818, subsequently devoted himself to the management of his great landed estate in central and northern New York, and was very successful in matters of his business. His credit is indicated by a well-known anecdote of the financial panic of 1837. In need of ready money, he obtained from John Jacob Astor a loan of $250,000, agreeing to execute mortgages on certain tracts of land as security. The mortgages were duly executed, but were not forwarded by the county clerk. Astor had loaned a quarter of a million on the basis of a verbal arrangement only, and for weeks remained satisfied. To many, Smith was known simply for his wealth and his use of it. During his life he gave away more than $8,000,000. His name was at the head of almost every subscription list of the time. A large portion of his beneficences fell to various established institutions, but much also to private charities in checks large and small. In 1846 he made a gift of 3,000 deeds, each for from 40 to 60 acres of land, to black and white poor. His efforts thus to further negro colonization in the North were unfortunately not successful, owing in part to the fact that the lands were unsuited to agriculture, but more to the fact that the negroes were as yet unfitted for independent farming. In 1825 Smith became a member of, and generous contributor to, the American Colonization Society, but withdrew from it in 1835 upon becoming convinced that it had nothing at all to do with the promotion of the anti-slavery cause in the United States, and joined the Anti-Slavery Society, of which he was thereafter a leading member. His object was the development of a public opinion that would demand abolition. By extensive correspondence, by frequent speeches, and by large gifts in money he furthered the movement of which he was, indeed, a most zealous exponent, but perhaps somewhat more genial then many. He assisted in the operation of the «underground railway»; and he furnished money to John Brown, though not implicated, as was alleged, in the Harper's Ferry attack. In politics Smith of course followed his reformatory views, and had no interest in party maneuvering. By politicians generally he was naturally considered an «intractable visionary.» He was defeated for the State senate in 1831. Under his leadership the Liberty party was formed at Arcade, Wyoming County, N. Y., 29 Jan. 1840; his idea was that neither of the two great parties was fitted to deal with slavery, but his purpose was general political reform and not simply abolition, as was popularly understood. The party had never great strength, its constituency being neither well organized nor well directed for party ends. By 1860 it was virtually dead. Smith was its candidate for the presidency in 1848 and 1851. The «Industrial Congress» at Philadelphia nominated him for the

Digitized by Google

presidency in 1848, the Land Reformers in 1856; both nominations were declined. He was an unsuccessful candidate for governor of New York in 1858 on the Anti-Slavery ticket. In 1853 he was elected to Congress by a plurality as an «Independent.» He served one session and then resigned, after having made several clear and decided speeches, one a powerful attack on the «Nebraska bill» 6 April 1854. During the Civil War he vigorously supported the government, but after it, holding that the North was not blameless in the matter of slavery, counseled moderation toward the South, and in accordance with this view went on the bail-bond of Jefferson Davis with Horace Greeley, and interceded in behalf of «Ku-Klux» prisoners at Albany. Subsequently he was active in various measures, among them the assistance of Mazzini, the Italian patriot. He withdrew from the Presbyterian Church, and built an edifice at Peterboro for a non-sectarian congregation, before which he sometimes preached. Smith was much persecuted, like most of those who in a prominent way disregard expediency and circumstance. Garrison, often at odds with him, wrote after his death: «His case is hardly to be paralleled among the benefactors of mankind in this or any other country.» Smith's more important writings are: 'Speeches in Congress' (1856); 'Sermons and Speeches' (1861); 'The Theologies' (1866); 'Nature's Theology' (1867); 'Letter from Gerrit Smith to Albert Barnes' (1868). Consult the biography by Frothingham (1878).

Smith, Gerritt, American composer and organist, grandnephew of the preceding: b. Hagerstown, Md., 11 Dec. 1859. He studied music abroad, was organist in St. Paul's Cathedral, at Buffalo, N. Y., and St. Peter's Church, at Albany, N. Y. Since 1885 he has been organist of the South Church, Madison Avenue, New York, where he has given nearly 300 recitals. He is professor of music at Union Theological Seminary, honorary president of the Guild of American Organists, and a well known writer on musical topics, his compositions including over 50 songs and instrumental pieces and the cantata 'King David.'

Smith, Goldwin, English scholar and author: b. Reading, Berkshire, 13 Aug. 1823. He was graduated from Oxford (University College) in 1845, became fellow of his college in 1847, was called in that year to the bar at Lincoln's Inn, in 1850 was made assistant-secretary of the royal commission on the state of Oxford University, and in 1858–66 was regius professor of modern history at Oxford. His lectures on Cromwell claimed attention and aroused controversy. In 1862–5 he co-operated with Bright in exerting his influence in favor of the American Union, by speeches, by signed articles, and by anonymous contributions on politics to the 'Saturday Review,' then very powerful. From 1868 to 1871 he was professor of English and constitutional history in Cornell University, but then removed to Toronto, Canada, where he edited the 'Canadian Monthly' (1872–4), and founded 'The Bystander' (no longer published) and 'The Week.' He was a consistent advocate of the annexation of Canada to the United States, his 'Canada and the Canadian Question' (1891) being a valuable hand-book of argument. His 'United States: An Outline of Political History 1492–1871' (1893) is an excellent work. Among his other volumes are: 'Lectures on the Study of History' (1861); 'The Empire' (1863); 'Irish History and Irish Character' (1863); 'Three English Statesmen' (Pym, Cromwell, Pitt) (1867); 'Cowper' ('English Men of Letters' 1880); 'The Moral Crusader, William Lloyd Garrison' (1892); 'Bay Leaves' (renderings from Latin poets) (1893); and 'Essays on Questions of the Day' (1894; rev. ed. 1904); 'My Memory of Gladstone' (1903). In his many contributions to periodicals he is known for his philosophical interpretation of current political and social phenomena. His writings show great impartiality and literary skill. Died Toronto, 7 June 1910.

Smith, Green Clay, American Congressman and Baptist clergyman: b. Richmond, Ky., 2 July 1832; d. Washington, D. C., 29 June 1895. He was graduated from Transylvania University in 1850, and admitted to the bar in 1853. In 1860 he was elected to the Kentucky legislature, but resigned this office to take active part in the Civil War. He was promoted colonel in the Union army in 1862, and brigadier-general of United States volunteers in the following year. Resigning his commission he sat in the 38th and 39th Congresses and in 1866 became governor of the Territory of Montana. He retired from political life to study for the ministry in 1869, was pastor of a Baptist church in Frankfort, Ky., and at the time of his death pastor of the Metropolitan Baptist Church of Washington, D. C.

Smith, Gustavus Woolson, American army officer: b. Scott County, Ky., 1 Jan. 1822; d. New York 23 June 1896. He was graduated from the United States Military Academy in 1842 and assigned to duty at Fort Trumbull, in whose construction he assisted. He was assistant professor of engineering at West Point from 1844 to 1846, but was transferred to active service in the war with Mexico. He was brevetted captain 20 Aug. 1847, and was engaged in the siege of the City of Mexico in the following month. In 1861 he entered the Confederate army and at the expiration of the war retired to private life.

Smith, Harry Bache, American playwright: b. Buffalo, N. Y., 1860. Before writing for the stage he spent some years as literary and dramatic critic for the newspapers of Chicago. He is the librettist of a number of well-known light operas, the most popular among which are: 'Robin Hood'; 'The Little Corporal'; 'The Tar and the Tartar'; 'Foxy Quiller'; 'Boccaccio,' and 'The Viceroy.'

Smith, Henry Boynton, American theologian: b. Portland, Maine, 21 Nov. 1815; d. New York 7 Feb. 1876. He was graduated from Bowdoin in 1834, studied theology at Andover and at Bangor, and subsequently in Halle and Berlin. He became pastor of the Congregational Church at West Amesbury, Mass., in 1842, but in 1847 accepted the chair of mental and moral philosophy at Amherst. He was professor of church history in Union Theological Seminary, New York, in 1850–5, and occupied the chair of systematic theology there 1855–73, after which he became professor emeritus. He

Digitized by Google

founded the 'American Theological Review' in 1859 and edited it until 1862 when it was merged in the 'Presbyterian Review,' of which he was editor until 1871. He was the author of 'The Relations of Faith and Philosophy' (1849); 'An Argument for Christian Churches' (1857); 'History of the Church of Christ in Chronological Tables' (1859); and edited and partially translated Gieseler's 'Church History' (5 vols., 1859–63); translated Hagenbach's 'History of Christian Doctrine' (1861–2); etc. Consult 'Memoirs,' edited by his wife (1881); and the biography by Stearns (1892).

Smith, Henry John Stephen, Irish mathematician: b. Dublin 2 Nov. 1826; d. 3 Feb. 1883. He was graduated from Balliol, Oxford, in 1850, and the same year began to lecture on mathematics there and continued in this lectureship until 1873. In 1860 he was also appointed to the Savilian chair of geometry at Balliol. His development of the theory of numbers placed him among the greatest mathematicians of his day. He is also known for his demonstrations of a great number of advanced theorems in higher mathematics. His mathematical papers were collected in 1894 in two volumes, to which was prefixed a biographical sketch by Charles H. Pearson (q.v.).

Smith, Henry Preserved, American educator: b. Troy, Ohio, 23 Oct. 1847. He was graduated from Amherst in 1869, studied at Lane Theological Seminary, Cincinnati, Ohio, in Berlin and in Leipsic, and in 1864 was ordained in the Presbyterian Church. He occupied a chair at the Lane Theological Seminary in 1877–93, when he resigned because of the charge of heresy brought against him by the Cincinnati Presbytery. He was convicted of the charge by both the Presbytery and the General Synod and thereupon retired from the Presbyterian Church. Since 1898 he has been a professor at Amherst. He has published: 'Inspiration and Inerrancy' (1893); 'The Bible and Islam' (1897); 'A Commentary on the Book of Samuel' (1899); etc.

Smith, Hezekiah Wright, American engraver: b. Edinburgh, Scotland, in 1828. He came to America in 1833 and subsequently entered the establishment of an engraver in New York. He studied with the mezzotintist, Thomas Doney, and in 1850 removed to Boston, where he worked for publishing firms. He executed plates of Daniel Webster, Edward Everett and Washington, the last being regarded the best rendering yet produced of Gilbert Stuart's «Atheneum head.» In 1870 Smith returned to New York and seven years later established himself in Philadelphia. In 1879 he abandoned engraving and his subsequent history is unknown.

Smith, Hoke, American lawyer and cabinet officer: b. Newton, N. C., 2 Sept. 1855. He was admitted to the bar at Atlanta, Ga., in 1873, and soon after became an active member of the Democratic party of that State. In 1887 he became the proprietor of the Altanta *Evening Journal.* He was a delegate to the Democratic national convention in 1892, and was appointed secretary of the interior by President Cleveland in 1893. He resigned this office to resume his law practice in Georgia in 1896.

Smith, Horatio (always called HORACE), and **James,** English authors: b. London 31 Dec. 1779, and London 10 Feb. 1775; d. Tunbridge Wells 12 July 1849, and London 24 Dec. 1839. James Smith became solicitor to the board of ordnance, and Horace a stock-broker. Being both of a literary turn, the brothers became contributors to the 'Pic Nic' newspaper, founded in 1802, and from 1807 to 1810 contributed numerous papers to the 'Monthly Mirror,' among these the 'Imitations of Horace,' which were afterward published separately. In 1812 the competition offered by the management for the best address to be read at the opening of Drury Lane Theatre, when rebuilt after the fire, suggested to the Smiths the idea of producing a collection of parodies of the most noted writers of the day, under the title, 'Rejected Addresses.' The work on being issued was hailed with the most enthusiastic applause, and rapidly ran through numerous editions. Its popularity still continues great, and deservedly, for few *jeux d'esprit* are more happy than the burlesques of the poetry of Wordsworth, Crabbe, and Sir Walter Scott (undoubtedly the best; Scott said of it, «I certainly must have written this myself, although I forget upon what occasion»), the pompous prose of Johnson, or the bluntness of Cobbett. Jeffreys said he took the 'Addresses' to be the «very best imitations, and often of difficult originals, that ever were made.» Calverley alone has equalled them. James, satisfied, did no more literary work save a few comic songs and some *vers de société;* but Horace set himself to the writing of novels, and produced among others 'Brambletye House' (1826); 'Reuben Apsley' (1827); 'The Moneyed Man' (1841); 'Adam Brown' (1843).

Smith, Isaac Gregory, Anglican clergyman and author: b. Manchester 21 Nov. 1826. He was educated at Rugby and Oxford, and in 1848 became fellow of Brasenose College. He became rector of Tedstone, Delamere, Herefordshire in 1854; prebendary of Hereford Cathedral in 1870; vicar of Great Malvern in 1872 and honorary canon of Worcester. He was Bampton lecturer in 1873 and since 1896 has been rector of Great Shefford, Berkshire. He is the author of 'Faith and Philosophy'; 'Epitome of the Life of our Saviour' (1867); 'The Silver Bells' (1869); 'Fra Angelico and Other Poems' (1871); 'Aristotelianism'; 'History of Christian Monasticism'; and various other works.

Smith, Isaac Townsend, American banker: b. Boston 12 March 1813; d. New York city 30 March 1906. He entered commercial life as supercargo, making several East India voyages in 1834–8. He afterward settled in New York as merchant and ship owner; then became one of the incorporators and for many years president of the Metropolitan Savings Bank. He was during 1878–84 commissioner of immigration for the State of New York; and acted as presidential elector at the re-election of Abraham Lincoln in 1864. At the opening of commercial relations between Siam and the United States in 1845 he became financial agent for Siam, and served in that capacity or as consul and consul-general at New York till his death.

Smith, James Argyle, American military officer: b. 1 July 1831; d. Jackson, Miss., 6 Dec, 1901. He was graduated from the United States

Digitized by Google

Military Academy in 1853, but at the outbreak of the Civil War joined the Confederate army, and was promoted brigadier-general in 1863. From 1878 to 1882 was superintendent of education of the State of Mississippi. Eleven years later he was restored to the United States army, and during the next four years was on duty at various army posts in the West.

Smith, Sir James Edward, English naturalist: b. Norwich 2 Dec. 1759; d. there 17 March 1828. He studied medicine at Edinburgh College, but while there became interested in botany and subsequently devoted himself to that field. In 1784 he purchased the famous botanical collection of Linnæus, and later pursued his studies at Leyden and elsewhere on the Continent. In 1797 he began the practice of medicine at Norwich, but continued to spend a part of each year in London, where he lectured before the Royal Institution. He is the author of 'English botany,' 36 vols. (1792–1807); 'Flora Britannica' (1800–4); 'Flora Græca' (1808); etc.

Smith, James Francis, American soldier: b. San Francisco, Cal., 28 Jan. 1859. He was graduated from Santa Clara College in 1878, studied law and was admitted to the bar in 1881. He was appointed colonel of the 1st California regiment in April 1898, embarked in the first expedition to the Philippines, fought in the battle of Malate Trenches 31 July and at the taking of Manila 13 August. Soon after the capture of the city he was made deputy provost marshal of Manila. He served on the commission to confer with Aguinaldo's commission in January 1899, took part in the battle of Santa Aña 5 Feb. 1899, and in March was given command of the island of Negros. He was made brigadier-general in April 1899 and given command of the department of Visayas. In July he was appointed military governor of Negros; in 1900 collector of customs of Philippine archipelago; in 1901 associate justice of the supreme court, Philippines; in 1903 member of the Philippine commission and secretary of Public Instruction; and 1906 Governor-General.

Smith, John, English soldier and colonist, founder of Virginia: b. Willoughby, Lincolnshire, 1580; d. London June 1631. In 1596 he enlisted in the French army to fight against Spain, but after the peace in 1598 transferred his services to the insurgents in the Netherlands, and there remained until about 1600. After study of the theory of warfare and practice in the cavalry exercises of the time, he started on a career of marvellous adventure, performing no end of exploits, for which his own narratives are the only authority. Having shipped, he says, from France for Italy, he was thrown overboard as a Protestant, but ultimately was rescued by a pirate, and after receiving a share of booty from a Venetian prize, went through Italy and Dalmatia to Styria, and enlisted in the forces of the Archduke of Austria against the Turks. He places emphasis upon his ingenuity in the device of a system of signaling by means of which the imperial army was enabled to communicate with the invested garrison of Limbach and thus raised the siege. After having killed three Turkish champions in a series of duels before the assembled armies, he was at last taken prisoner at Rotenturm, and sold as a slave. But he escaped, and finally got to Morocco, whence he returned in an English warship to England in 1605. Fuller ('Worthies of England') thought of these "strange performances" that their scene was "laid at such a distance they are cheaper credited than confuted." Later investigators allow them some basis of truth. When Smith got back he busied himself in the schemes of colonization in the New World which were being undertaken in consequence of the recent discoveries. An enterprise with which he was identified for a settlement in Guiana fell through, and he then sailed from Blackwall 19 Dec. 1606 among the 105 emigrants who, under royal patent, were to establish a colony in Virginia. In the passenger-list he is styled a planter. The expedition of three vessels went by way of the West Indies, reached the coast of Virginia on 26 April, and then opened the sealed instructions containing the list of members of the council. Among them was Smith, who was not at first permitted to act because during the voyage for some reason unknown he had been placed under arrest by Captain Newport, commander of the fleet. On 13 May 1607 the colonists landed about 50 miles from the mouth of the river they called the James, at a peninsula on its northern bank, where they built Jamestown. The site was strongly approved by Smith, though opposed by Bartholomew Gosnold, another of the council. From the start Smith was active in the work of the colony, and on 10 June he was admitted to office. Fortifications were built, and then he made excursions into the surrounding region for food. He proved an excellent leader, and soon became virtually the director of the colony. During one of his journeys he was taken prisoner by the Indians (December 1607), but later released on promise to furnish a ransom of "two great guns and a grindstone." In an interpolation in his 'Generall Historie' (1624), Smith says that it was during this captivity that he was saved from death by Pocahontas (q.v.). Charles Deane (q.v.), the antiquary, in his edition (1860) of Wingfield's 'Discourse,' was the first to point out that the story was at variance with Smith's narratives in the tracts composing the book when they were published contemporaneously with the events they recorded. But Smith has found many defenders, such as Arber in his memoir in the 'Encyclopædia Britannica' (9th ed. 1887) and his edition (1884) of Smith's 'Works,' and Poindexter in 'Captain John Smith and his Critics' (1893). The matter, like Smith's general veracity, remains an object of controversy. Wingfield, the first elected president of the colony, was deposed in September 1607, Smith taking a leading hand in the business. Ratcliffe, the successor, held office a year, and 10 Sept. 1608 Smith was made formal head. He enforced discipline, strove to correct the unthrifty methods of the colonists, had them build a church, strengthen the defenses, and make some provision for agriculture and fishery. He made two voyages, covering in all, he reckoned, 3,000 miles, about the coasts of Chesapeake Bay, which he mapped with its environs. A new party of colonists arrived in August 1609. Smith refused to surrender the government of the colony, and the newcomers chose Francis West president. Smith's term having later expired, George Percy was elected and West made a councillor. About

Digitized by Google

29 September Smith left for England. He never returned to Jamestown. He left the colony in a most favorable condition. In 1614 he made a voyage of exploration to New England and prepared a map of the coast from the Penobscot to Cape Cod, the first properly to indicate the outline of it. He made two attempts in 1615, being frustrated in the first by a storm and in the second by being taken prisoner by the French. In 1617 he started again, but bad weather kept him in port, and he retired to London where he made maps and wrote pamphlets. Smith was certainly a prominent figure of his time, and whatever his tendency to embellishment and imagination as a historian, he really achieved much in Virginia. He was a good example of Elizabethan versatility, «bookman, penman, swordsman, diplomat, sailor, courtier, orator.» His service to America in the early 17th century remains the greatest part of his career. His ‹Works› were definitely edited by Arber for the ‹English Scholar's Library› (1884). Consult also: Neill, ‹English Colonization of America› (1871); Tyler, ‹History of American Literature› (1879); Warner, ‹Life and Writings of John Smith› (1881); Doyle, ‹English in America› (1881-2); True's ‹Memoir› (1882); Winsor, ‹History of America› (1886); and the biographies by Hillard (1834); Robinson (1845); Simms (1846); Hill (1858), and Woods (1901). See JAMESTOWN.

Smith, John Lawrence, American chemist and physician: b. Charleston, S. C., 17 Dec. 1818; d. Louisville, Ky., 12 Oct. 1883. He was educated at the University of Virginia and the South Carolina Medical College, studied chemistry in Europe with Liebig and Pelouze, and established in 1846 the «Medical and Surgical Journal of South Carolina.» He was appointed bullion assayer by the State of South Carolina; and in 1846 entered the service of the Turkish government to report upon the cotton culture and the mineral resources of Turkey. He returned to America in 1850 and taught chemistry in the medical department of the University of Louisville 1854-66. He made one of the largest known collections of meteorites, which after his death was acquired by Harvard University. He received decorations from the French, Turkish, and Russian governments; was president of the American Association for the Advancement of Science in 1874, and of the American Chemical Society in 1877; and in 1879 succeeded Sir Charles Lyell as corresponding member of the Academy of Sciences of the Institute of France. The more important of his numerous published papers were issued by him as ‹Mineralogy and Chemistry, Original Researches› (1873-84).

Smith, John Pye, English Congregational theological writer: b. Sheffield 25 May 1774; d. Guilford, Surrey, 5 Feb. 1851. In 1796 he edited the ‹Iris› newspaper during the imprisonment of his friend James Montgomery (q.v.). He studied at Rotherham Academy and in 1800 was appointed tutor in Homerton College, a connection he continued until a short time before his death. Among his writings are treatises on the ‹Divinity of Christ›; ‹Holy Scriptures and some parts of Geological Science› (1839), a work receiving the commendation of men like Whewell, Herschel, Sidgwick, and Baden Powell; ‹Scripture Testimony to the Messiah› (1818-21); and ‹Principles of Interpretation as applied to the Prophecies of Holy Scripture› (1829).

Smith, John Talbot, American Roman Catholic clergyman, author and lecturer: b. Saratoga, N. Y., September 1855. He was graduated from St. Michael's College, Toronto, Ontario, was engaged in missionary work in the Adirondack regions 1881-9, was editor of the New York ‹Catholic Review› 1889-92. He has published ‹A Woman of Culture› (1881); ‹His Honor the Mayor› (1891); ‹Saranac› (1893); ‹Brother Azarias› (1897); ‹Lenten Sermons› (1899); etc.

Smith, John Walter, American politician: b. Snow Hill, Md., 5 Feb. 1845. He was educated at Washington Academy. As a member of the Democratic party he was elected to the Maryland State Senate in 1888, serving there till 1899; in 1894 he was president of the Senate; and in 1895 chairman of the Democratic State Committee. In 1896 he was an unsuccessful candidate for the United States Senate, and in 1898 was elected to Congress. From 1900-04 he was governor of Maryland, and on 15 Jan. 1908 was appointed United States Senator for six years beginning in 1909.

Smith, Joseph, American naval officer: b. Boston, Mass., 30 March 1790; d. Washington, D. C., 17 Jan. 1877. His first active service was in the battle of Lake Champlain, 11 Sept. 1814. He was promoted captain in 1837, and from 1843 to 1845 commanded the Mediterranean squadron, at the expiration of which service he was transferred to shore duty, and became chief of the bureau of yards and docks. He became rear-admiral in 1862, and was placed upon the retired list.

Smith, Joseph, American Mormon leader: b. Sharon, Windsor County, Vt., 23 Dec. 1805; d. Carthage, Ill., 27 June 1844. In 1820, when living as a farm laborer at Manchester, Ontario (now Wayne) County, N. Y., at the time of a religious revival he prayed, according to his own account, for guidance, but was told by two heavenly messengers not to join any sect. On 21 Sept. 1823 an angel that he called Moroni told him of a book engraved on gold plates and containing the «fulness of the everlasting gospel.» He was instructed to dig for the plates in the hill Cumorah, four miles from Palmyra, between that town and Manchester. These plates, the characters on which were in a tongue styled «reformed Egyptian,» Smith translated, sitting behind a curtain while amanuenses received his dictation. Smith received the priesthood of Aaron from John the Baptist, and of Melchizedek from Peter, James, and John. On 6 April 1830 the Mormon Church was organized at Fayette, Seneca County, N. Y., and Smith was recognized as a prophet, signalizing his «new dispensation» by casting out a devil from Newell Knight, of Colesville, Broome County. (For subsequent details of Smith's career see MORMONS.) Smith was frequently arrested, and while at Nauvoo, Ill., refused to acknowledge the validity of a warrant and had the sheriff conducted out of town by the city marshal. He was then arrested and placed in jail at Carthage on the charge of treason. While he was there a mob, the result of animosities caused by the theocratic claims of the «Saints,» broke into the prison and murdered him.

Digitized by Google

JOSEPH F. SMITH,

PRESIDENT OF THE CHURCH OF LATTER-DAY SAINTS.

Digitized by Google

Smith, Joseph, American Mormon, son of the preceding: b. Kirtland, Ohio, 6 Nov. 1832. After the removal of the Mormons to Utah he remained with his mother, who refused to recognize the authority of Brigham Young. He engaged in hotel keeping and farming with his mother's people, then studied law, and in 1860 became president of the Reorganized Church of Jesus Christ of Latter Day Saints, that body being opposed to polygamy and not recognizing the church in Utah. Since 1863 he has edited the 'Saints' Herald,' the religious organ of the denomination.

Smith, Joseph Fielding, American religious leader, president of the Church of Jesus Christ of Latter Day Saints, nephew of Joseph Smith (1805–44): b. Far West, Caldwell County, Mo., 13 Nov. 1838. His childhood was spent amid persecutions and hardships which finally resulted in the martyrdom of his uncle and his father in Carthage, Ill., 27 June 1844. In 1846 his mother with her family left her home in Nauvoo, Ill., as an exile, with the majority of the Latter Day Saints, who were driven from their homes. In this exodus, Joseph drove an ox-team to Winter Quarters, on the Missouri River, where the family remained until the spring of 1848, when they continued their journey to the West. From Winter Quarters to the Salt Lake Valley, Joseph drove two yoke of oxen attached to a heavy-laden wagon, a distance of more than 1,000 miles, and arrived in the valley 23 Sept. 1848. He was engaged in manual labors 1848–54, and in the last named year went as a missionary to the Hawaiian Islands, where he remained until 1857, gaining a thorough knowledge of the native tongue. He returned to Utah in 1858 and on 21 March 1858 was ordained to the office of a Seventy and on 16 October of the same year to the office of a High Priest and member of the High Council of the Salt Lake Stake. He labored as a missionary in Great Britain 1860–3 and in 1864 returned to the Hawaiian Islands on his second mission, where he resided until his return to Utah in 1865. While on his third mission to the Hawaiian Islands, 1885–7, he became acquainted with Professor L. L. Rice, the possessor of the original manuscript of the much famed 'Spaulding Story' which many over-zealous anti-"Mormons" have tried in every possible way to connect with the Book of Mormon, and from him he obtained an exact copy of the manuscript, which has since been published in book form. On 1 July 1866 he was ordained an apostle and was received into the quorum of the Twelve Apostles 6 Oct. 1867. In February 1874 he started on his second mission to Europe, this time to preside over the European mission and to edit the 'Millennial Star,' the Church periodical in England. He remained there until the fall of 1875, when he returned to Utah and was appointed to preside over the Latter Day Saints in Davis County. This position he held until the spring of 1877 when he was again appointed to preside over the European mission, and for the third time left for Great Britain. He traveled in this field, visiting the different branches in England and on the Continent, until the death of President Brigham Young, 29 Sept. 1877, when he was called home. He was 2d counsellor to the presidency 1880–1901, and 1st counsellor April 1901 to 10 Oct. 1901. On the last named date he was chosen president of the Church.

President Smith's civic record comprises the offices of Territorial legislator, city councillor, and university regent, in all of which he served repeatedly. As a member of the municipal government he was the main mover in securing from the heirs of President Brigham Young Liberty Park and Pioneer Square as public parks for Salt Lake City. He was a member of the House of the Utah legislature 1865, and in 1882 was a member of the legislative council, presiding over it at the latter session. He was also president of the constitutional convention held the same year. He assisted in the organization of Zion's Co-operative Mercantile Institution, Zion's Savings Bank & Trust Co., the State Bank of Utah, and the Utah Sugar Co., over all of which he is now the president. He is also president of the Consolidated Wagon & Machine Co., The Utah Light & Power Co., and is connected with many other concerns.

In the auxiliary organizations of the Church he is the head of the Young Men's Mutual Improvement Association and the Deseret Sunday School Union, and is the senior editor of the 'Improvement Era' and the 'Juvenile Instructor,' the official organs of these two organizations of young people of the Church.

Early in 1904 President Smith was summoned to Washington to testify before the Senate Committee of Privileges and Elections in the case of Reed Smoot (q.v.), senator-elect from Utah, upon whose eligibility the committee was called to pass. During a prolonged examination the witness displayed a mental resourcefulness scarcely less than that of his distinguished interrogators.

Smith, Joseph Lindon, American artist: b. Pawtucket, R. I., 11 Oct. 1863. His art studies, begun at the Museum of Fine Arts in Boston, were continued at the Académie Julien in Paris. His best known work includes mural decorations in the Boston Public Library and in Horticultural Hall, Philadelphia.

Smith, Julia Holmes, American physician: b. Savannah, Ga., 23 Dec. 1839. She began the study of medicine in 1873 at the medical school of the Boston University and graduated from the Chicago Homœopathic College in 1877. Since then she has practised in Chicago and contributed to medical literature. Upon appointment by Gov. Altgeld she became the first woman trustee of the University of Illinois. She has been professor of gynecology and dean of the National Medical College; superintendent of the Department of the Northwest, New Orleans Cotton Exposition, 1885, and vice-president Homœopathic Congress, Columbian Exposition, 1892–3. She organized and was first president of the Woman's Medical Association.

Smith, Justin Harvey, American writer: b. Boscawen, N. H., 13 Jan. 1857. He was graduated from Dartmouth College in 1877, and became a member of the publishing firm of Ginn & Co. In 1899 he was called to the chair of modern history at Dartmouth. He is the author of: 'The Troubadours at Home' (1899); 'Arnold's March to Quebec' (1903).

Smith, Mary Prudence Wells, American writer for young people: b. Attica, N. Y., 23

Digitized by Google

July 1840. She was graduated from the Greenfield High School in 1858. She has published 'Jolly Good,' a series of stories for the young (1875-95); 'Miss Ellis's Mission' (1886); 'The Young Puritans of Old Hadley' (1897); 'The Young and the Old Puritans of Hatfield' (1900); 'The Boy Captive of Old Deerfield' (1904).

Smith, Melancton, American naval officer: b. New York 24 May 1810; d. Green Bay, Wis., 19 July 1893. He entered the navy as midshipman, was commissioned lieutenant in 1837, served in the Florida war on the Poinsett, and during the Civil War joined Farragut's fleet with the Massachusetts, destroyed the Confederate ram Manassas, and took part in running the batteries at Vicksburg 14 March 1862. He was promoted commodore in 1866 and rear-admiral in 1870, and was commandant at the Brooklyn navy yard 1870-2.

Smith, Munroe, American political scientist: b. Brooklyn, N. Y., 8 Dec. 1854. He was graduated from Amherst in 1874, and from the Columbia Law School in 1877; he then studied abroad, receiving the degree of J.U.D. (doctor of laws) from the University of Göttingen. On his return from Germany in 1880 he was appointed instructor in the department of history at Columbia University, in 1883 became adjunct professor of history, and in 1891 professor of Roman law and comparative jurisprudence. He was one of the founders of the 'Political Science Quarterly' in 1886, of which he has since been the editor. He has edited 'Selections from Cicero' in 'The World's Best Books' (1900); and has written 'Bismarck and German Unity' (1898); 'Germany in the 19th Century' (1901); and numerous historical and legal articles.

Smith, Orlando Jay, American soldier and journalist; b. near Terre Haute, Ind., 14 June 1842; d. near Dobbs Ferry, N. Y., 20 Dec. 1908. He was graduated from Asbury, now De Pauw University, and served with distinction in the Federal army during the Civil War. He has since been editor of the 'Terre Haute Mail,' 'Terre Haute Gazette,' Terre Haute 'Express,' and the 'Chicago Express,' and has published 'A Short View of Great Questions' (1899); 'The Coming Democracy' (1900).

Smith, Persifor Frazer, American soldier: b. Philadelphia, Pa., November 1798; d. Fort Leavenworth, Kan., 17 May 1858. He studied law, became adjutant general of Louisiana, served as a colonel of volunteers in the Seminole war, and commanded a brigade in the Mexican War. He was appointed military governor of Vera Cruz in 1848, and subsequently commanded the departments of California and Texas. In 1849 he was brevetted major-general for his services at Monterey, and in 1856 brigadier-general for those at Contreras and Churubusco.

Smith, Richard Penn, American dramatist: b. Philadelphia 13 March 1799; d. Falls of Schuylkill, Pa., 12 Aug. 1854. He was the author of numerous plays, 15 of which were produced on the Philadelphia stage. Among them are 'Caius Marius,' a tragedy acted by Edwin Forrest in 1831; 'The Disowned' and 'The Deformed,' both presented in London; 'The Water Watch'; 'The Venetians'; and 'The Actress of Padua.' A selection of his 'Miscellaneous Works,' collected by his son Horace Wemyss Smith, and including a biographical sketch, was published in 1856; and 'Complete Works' with sketch and memoir was published by his son in 1888 (four vols.). Consult Rees, 'Dramatic Authors of Philadelphia.'

Smith, Richard Somers, American educator: b. Philadelphia, Pa., 30 Oct. 1813; d. Annapolis, Md., 23 Jan. 1877. He was graduated from West Point in 1834, served on topographical duty, and resigned in 1836. He was reappointed to the army in 1840, and became instructor at West Point, which position he held until 1855, when he again resigned, serving successively as professor of mathematics in the Brooklyn Institute of Technology and as a director of Cooper Institute, New York. In 1861 he was appointed to the Federal army for a third time; he served, as major of infantry, until after the battle of Chancellorsville, when he resigned his commission and accepted the presidency of Girard College, Philadelphia. He relinquished this in 1867; in 1870 was appointed professor of mathematics at the United States Naval Academy, and in 1873 was transferred to the department of drawing. His publications comprise a 'Manual of Topographical Drawing' (1853), and 'Linear Perspective' (1857).

Smith, Robert, English mathematician: b. 1689; d. Cambridge 1768. He became Plumian professor of astronomy at Cambridge 1716, and master of Trinity College 1742. He bequeathed large sums for university and college purposes, on which are founded the Cambridge and Trinity "Smith Prizes," awarded annually for the best essay on mathematics or natural philosophy. He published 'Harmonia Mensurarum' (1722); 'A Complete System of Optics' (1738); 'Harmonics' (1748); and edited a work on hydrostatics and pneumatics.

Smith, Robert Angus, English chemist: b. near Glasgow, Scotland, 1817; d. Colwyn Bay 11 May 1884. He studied chemistry under Liebig at Giessen, and settled as a consulting chemist at Manchester, England. His reports on the sanitary conditions of towns in various parts of England brought the subject prominently before the public mind, and his subsequent investigation of the organic impurities of the air in mines secured him the appointment to be inspector-general of the alkali works of the United Kingdom (1863). He was likewise inspector for Great Britain under the "Rivers Pollution" Act. He published 'Disinfectants' (1869); 'Air and Rain' (1872).

Smith, Samuel, American soldier: b. Lancaster, Pa., 27 July 1752; d. Baltimore, Md., 22 April 1839. He was appointed captain in a Maryland regiment at the outbreak of the American Revolution and served until 1779, having been in command of Fort Mifflin when it was bombarded by the British fleet for 42 days in 1777. He resigned his commission in 1779, represented Maryland in Congress 1793-1803 and 1816-22, and in the United States Senate 1803-15 and 1822-33, serving much of the time as chairman of the finance committee. As major-general of the State militia he defended Baltimore from mob rule in 1835, and for three years afterward was mayor of that city.

Smith, Samuel Francis, American Baptist clergyman and poet: b. Boston, Mass., 21 Oct.

Digitized by Google

1808; d. there 16 Nov. 1895. He was graduated from Harvard in 1829, from Andover Theological Seminary in 1832, and was ordained in 1834. He was engaged in various pastorates in 1834–54, at the same time acting as professor of modern languages at Waterville College (Colby University) in 1834–42, and as editor of the Boston 'Christian Review' in 1842–8. He was editor of the publications of the Baptist Missionary Union in 1854–69, and in 1875–6, 1880–2, he visited the chief missionary stations in Europe and Asia. He was famous as the author of 'My Country 'Tis of Thee' (1832), which became a national hymn, and he also wrote the hymn 'The Morning Light is Breaking' at about the same time. His publications include: 'Lyric Gems' (1843); 'The Psalmist' (1843); 'Life of Rev. Joseph Grafton' (1848); 'History of Newton, Mass.' (1880); 'Rambles in Mission Fields' (1884); etc.

Smith, Seba, American journalist: b. Buckfield, Maine, 14 Sept. 1792; d. Patchogue, L. I., 29 July 1868. He was graduated from Bowdoin College in 1818, and entered the journalistic world as a writer for the Portland papers. Under the pen name of Major Jack Downing, he began a correspondence in the dialect of New England bearing upon the political issues of the day, which was continued for some time, and, having been collected and published in book form in 1833, gained considerable popularity. From 1822 to 1842 he was the editor successively of three of the Portland papers, when, having acquired a somewhat wider reputation as a political satirist, he removed to New York, where he wrote for numerous periodicals. His later published works are: 'Powhatan' (1841) a tale in verse; 'New Elements of Geometry,' a parody (1850); and 'Way Down East' (1853).

Smith, Sidney, English clergyman, author, and wit: b. Woodford, Essex, 3 June 1771; d. London 22 Feb. 1845. He was educated at New College, Oxford, of which he became a fellow in 1791, and obtained in 1794 the curacy of Netheravon, a village in Salisbury Plain, near Amesbury. In 1796–1801 he was in charge of an Episcopal congregation at Edinburgh and tutor to Michael Hicks Beach. Here he continued for five years, and made the acquaintance of the most distinguished intellectual men of the day, including more especially that circle of youthful genius, composed of such men as Jeffrey, Horner, Walter Scott, Lord Brougham, Leyden, and others. Many of them espoused with ardor liberal views in politics and literature, and with the view of disseminating these Smith proposed to his comrades the starting of a 'Review,' a project entered upon with enthusiasm. Thus commenced in 1802 the famous 'Edinburgh Review,' of which Jeffrey acted as editor for many years, and Smith as one of its raciest and most influential contributors. In 1803 Smith removed to London, where he delivered a course of lectures on moral philosophy at the Royal Institution (1804–6), which were extremely popular, and were subsequently published. In 1806, during the reign of the Whig party, he was presented to the living of Fosbrooke, near York, in 1828 was given a prebend at Bristol, and in 1831 was made canon residentiary of St. Paul's, London. This was the utmost dignity to which he attained in the Church, it being generally believed that but for his Whig views he would have reached a bishopric. Not long afterward he came prominently forward in a series of pungent epistolary attacks on Lord John Russell, occasioned by his introduction of a bill into Parliament which materially encroached on the rights of deans and chapters. About his last literary effort was the exposure of the fraud perpetrated by the State of Pennsylvania in the repudiation of its public debts. Smith was himself a sufferer by this breach of national faith, and his sarcastic remarks on the subject excited both a little amusement in England and not a little indignation in the United States. Another characteristic publication was 'Letters on the Subject of Catholics' (1807–8), which was of influence in securing Catholic emancipation. A few years before his death a collected edition of his writing was published under his own superintendence. It has been said, "Smith's reputation as an English wit is solid,— if that word can be applied to so volatile a quality." He was one of the greatest of jesters and makers of *bon-mots,* but remarkable also as a thinker and English stylist. Consult: Reid, 'Life and Times of Sidney Smith' (1884); also the 'Memoir' by Lady Holland; and Duyckwick, 'Wit and Wisdom of Sidney Smith' (1856).

Smith, Sophia, American philanthropist: b. Hatfield, Mass., 27 Aug. 1796; d. there 12 June 1870. Her early life was spent in comparative obscurity, but was enlivened by a rather wide range of reading and the acquisition of such desultory knowledge as she could obtain thereby. Having been early impressed with the need of women for opportunities for higher education, it was her privilege to establish the first woman's college in New England by means of a fortune left her by a brother, Austin Smith, in 1861. Smith College (q.v.) was established in Northampton, Mass., in 1875, according to plans outlined by her and by means of funds bequeathed by her in 1870 for the founding of such an institution.

Smith, Thomas, English scholar and diplomatist: b. Saffron Walden, Essex, 1512; d. 1577. He studied at Queen's College, Cambridge, became a fellow there, 1531, and a public lecturer, 1538; he then studied at Padua and on his return became professor of civil law at Cambridge, 1544. During these years he succeeded in changing the English pronunciation of Greek. Under Edward VI. he was knighted, and served as ambassador to Belgium and France. He lived in retirement during Queen Mary's reign, but under Queen Elizabeth was ambassador to France, 1562–6; a member of the privy-council, 1571; and secretary of state, 1572. He published, besides two monographs on the Greek and the English languages, an important work on the Tudor constitution, called 'De Republica Anglorum' (1583).

Smith, Thomas Roger, English consulting architect. He has been professor of architecture in University College, London, from 1879. Among his professional books may be cited 'Elphinstone College and the Post Office, Bombay, India.' He has published 'Handbook of Architectural History'; 'Manual of Acoustics.'

Smith, Thomas Southwood, English reformer: b. Martoch, Somerset, 21 Dec. 1788; d.

Digitized by Google

Florence, Italy, 10 Dec. 1861. He was educated for the Church, but early in his ministerial career among the poor of Western England was impressed with the desire for a knowledge of medicine, and the necessity for improving the sanitary conditions of the homes of the people to whom his efforts were directed. He was graduated as a physician in 1812, and in 1820 began to practise in London. In 1825 he was appointed to the London Fever Hospital, and in 1830 published his 'Treatise on Fever' which is still regarded as a most able presentation of the subject. His interest in the industrial conditions of the laboring classes of London led to an inquiry into the subject of child labor which resulted in the passage of a Factory Act and the exclusion of children from work in the mines of Great Britain. He spent much time in investigating epidemics of cholera, yellow fever, and other contagious diseases, and rendered thereby a great service to medical science.

Smith, Uriah, American Seventh Day Adventist leader: b. West Wilton, N. H., 2 May 1832; d. Battle Creek, Mich., 6 March 1903. He studied at Harvard, became a Seventh Day Adventist and rose to great prominence in that denomination. He became editor of the 'Adventist Review' at Rochester, N. Y., in 1853 and removed to Battle Creek in 1855, when the office of this denominational organ was transferred to that city. He was at the head of the great denominational publishing house at Battle Creek, a professor of Bible study in the Adventist College, and wrote many religious works, which reached a sale of 200,000 copies. Among them are: 'The United States in the Light of Prophecy'; 'Daniel and the Revelation,' which attained a sale of 72,000 copies; 'The Sure Foundation.'

Smith, Walter Chalmers, Scottish Free Church clergyman and poet: b. Aberdeen 1824. He was educated at Edinburgh University, and entering the ministry became pastor of the English Presbyterian Church at Islington, London, in 1850. He subsequently held Free Church pastorates at Orwell, Kinross-shire, at the Tron Church, Glasgow, and the High Church, Edinburgh. He was arraigned for heresy in 1867, but the General Assembly dismissed the charges. He is well known as a poet, 'Olrig Grange' (1872) being widely read in this country and his own at the time of its appearance. Among other works by him are: 'Hymns of Christ and the Christian Life' (1867); 'Hilda' (1878); 'North Country Folk' (1887); 'A Heretic' (1891).

Smith, William, English geologist: b. Churchill, Oxfordshire, 23 March 1769; d. Northampton, 28 Aug. 1839. After receiving an irregular education, during the course of which he displayed considerable talent for mathematics, he in 1787 became an assistant to a land-surveyor. He afterward began to act as a mining surveyor, and was led from some of his surveys of collieries to the idea of framing a model of the strata of a coal country, composed of the materials of the strata reduced to a scale, and placed in their relative positions to each other. He next began seriously to contemplate the composition of regular and extensive works on the subject of geology, and in 1815 he was able to submit a complete colored map of the strata of England and Wales to the Society of Arts.

Smith, William Farrar, American soldier: b. St. Albans, Vt., 17 Feb. 1824; d. Philadelphia, Pa., 28 Feb. 1903. He was graduated from the United States Military Academy in 1845, and was commissioned 2d lieutenant in the Topographical Engineers, and from 1846–8 was assistant professor of mathematics at the academy. At the beginning of the Civil War he served under Gen. Butler, but later received command of a division of the Army of the Potomac which participated in the siege of Yorktown and in the battles of Williamsburg, Malvern Hill, and Antietam. He also took part in the battles of Fredericksburg (1862) and Gettysburg (1863). In 1863 he was appointed chief engineer of the Army of the Cumberland and planned the battles of Brown's Ferry and Missionary Ridge. At the close of the war he resigned from the army and became president of the International Ocean Telegraph Company and of the New York Board of Police.

Smith, William Henry, American journalist: b. Austerlitz, N. Y., 1 Dec. 1833; d. Lake Forest, Ill., 27 July 1896. He turned to newspaper work in 1854, being attached to the *Cincinnati Times*, first as reporter and later as managing editor. At the beginning of the Civil War he was an editorial writer on the *Gazette*, where his pen was active in the support of the government. In 1864–6 he was secretary of state of Ohio, but resigned before the completion of his second term and established the *Evening Chronicle* at Cincinnati. In 1870 he became general manager of the Western Associated Press, and in 1883 at the consolidation of the New York and Western associations retained the general managership of the body. Meantime, in 1877, he had been appointed collector of the port of Chicago, and he was instrumental in introducing customs methods to harmonize with the civil service policy of the government. He published 'The St. Clair Papers' (1882), a biography of Charles Hammond, and a 'Political History of the United States.' During researches in the British Museum he found unpublished letters of Washington to Col. Henry Bouquet and detected errors in those published by Jared Sparks. At the time of his death he was engaged on the 'Life and Administration of President Rutherford B. Hayes' and since his death has appeared his 'Political History of Slavery' (1903).

Smith, William Robertson, Oriental scholar: b. 1846; d. 31 March 1894. He was the son of the Free Church minister at Keig, Aberdeenshire; was educated at Aberdeen University, where he graduated in 1865, taking the highest honors. Subsequently he spent some time at the New College, Edinburgh, and continued his German studies at Bonn and Göttingen, where his ideas upon scientific research were acquired. Thereafter, from 1868 to 1870 he acted as assistant to Professor Tait, professor of physics in Edinburgh University. In 1870 he was appointed to the chair of Hebrew and New Testament exegesis in the Free Church College at Aberdeen. His free criticism of the Old Testament writings resulted in a charge of heresy, and after prolonged discussion in the Free Church courts, during which his honesty was no less conspicuous than his learning, he was

Digitized by Google

removed from his professorship in 1881. From this period he became associated with Professor Baynes in the editorship of the 'Encyclopedia Britannica,' and when the latter died he succeeded to the position of editor-in-chief. Meanwhile he had visited Arabia in 1879–80, where he gained an intimate knowledge of the people and their language, which qualified him to fill the position of professor of Arabic in Cambridge University, to which he was appointed in 1883. Subsequently he became a fellow of Christ's College, and in 1886 he was elected university librarian, a post which he exchanged in 1889 for the Adams professorship of Arabic. Probably his most popular works are 'The Old Testament in the Jewish Church' (1881), and the 'Prophets of Israel' (1882). But he is best known to scholars as the author of 'Kinship and Marriage in Early Arabia' (1885); and his first series of Burnett lectures, 'Religion of the Semites: Fundamental Institutions' (1889).

Smith, Sir William Sidney, British naval officer: b. Westminster 21 June 1764; d. Paris 26 May 1840. He entered the navy in 1777 and was assigned to one of the ships engaged in defending the English right to the American colonies. In 1783 he was promoted to the rank of port-captain, and attained distinction for valuable service rendered in defending the coast of Syria against Napoleon in 1799, and in the battle of Alexandria. In 1807 he was responsible for the destruction of a Turkish squadron off the Dardanelles. He was made an admiral of the British navy in 1821. Consult: Barrow, 'Life of Admiral Sir William Sidney Smith,' and Marshall, 'Royal Naval Biography,' Vol. I.

Smith, William Sooy, American army officer and engineer: b. Tarlton, Ohio, 22 July 1830. He was graduated from the United States Military Academy in 1853 and assigned to frontier duty. The following year he resigned his commission for more active life, and became assistant engineer of the Illinois Central Railroad. He practised the profession of an engineer in various cities of the United States until the beginning of the Civil War, when he entered the volunteer service. He was promoted brigadier-general 15 April 1862, and commanded successfully the 2d division of the Army of the Ohio, the 1st division of the 16th Army Corps, and the cavalry division of the Department of the Tennessee, but was obliged to retire from active service on account of prolonged illness in 1864. His fame as an engineer rests upon his many improvements of the method of sinking foundations for the security of high buildings, and in the use of pneumatic caissons in bridge building. His name is identified with the building of the first steel bridge, a structure which spans the Missouri at Glasgow, the construction of the Wangoshanee Lighthouse in the Straits of Mackinac, the Hudson River tunnel, and other bridge and railway work throughout the United States and Canada.

Smith College, located at Northampton, Mass. It was founded by Sophia Smith, who bequeathed $365,000 for "an institution of learning for the higher education of young women, with the design to furnish them means and facilities for education equal to those which are afforded in the colleges for young men." The college was incorporated in 1871, and opened to students in 1875; it is unsectarian in its management and instruction. The college has conferred the three degrees of A.B., B.L., and B.S., but after 1904 will confer only the degree of A.B. The course includes a year's work in eight required subjects, including Bible study, a major study consisting of related courses in the junior and senior years, two three-hour courses in the junior and senior years, one of which must be in a department entirely different from the major study, and free electives to complete the required number of hours. The curriculum includes music and art, and a certain amount of technical work in each department when combined with theoretical courses counts toward the degree. Formerly the departments of music and art were organized as separate schools, but in 1902 were co-ordinated with the other collegiate studies. The college was among the first to recognize music and art among the qualifications for the degree. Graduate work is provided for, and the degrees of A.M. and Ph.D. are conferred. Twenty-nine scholarships are provided, the largest of which has a fund of $10,000; there are also fellowships for advanced work in philosophy and psychology, botany and zoology; and the college aids in the support of the American women's table at the zoological station at Naples, entitling graduates to appointment to this station. Physical training is required of students, and much interest is also taken in out-door sports. The college has a large and beautiful campus, including the botanical gardens; the buildings (in 1904) are College Hall, Seelye Hall, Lilly Hall of Science, Chemistry Hall, the Observatory, Music Hall, the Hellyer Art Gallery, the Alumnæ Gymnasium, the Lyman Plant House, the Students' Building, the centre of the students' social life, with a large hall, rooms for clubs, etc., and a reading room, and 14 dwelling houses. The library contained 7,000 volumes in 1904 and the Northampton Public Library and the Forbes Library are also open to students. The productive funds in 1904 amounted to $1,078,000; the students numbered 1,033, and the faculty 98.

Smith Sound, a passage of water at the northern extremity of Baffin Bay, between Peary Land, in Greenland, and Ellesmere Land. It leads from Baffin Bay into Kane Basin, a body of water about 110 miles long. Its southern entrance was discovered by Baffin in 1616. In 1854 it was surveyed by a United States expedition under Dr. Elisha Kent Kane.

Smith'field, a historic square in London, a little north of Newgate and west of Aldersgate, which was until 1855 the only cattle market in London. It was outside the old city walls, and in the 11th century was an open spot where the citizens delighted to promenade. Before the days of Tyburn, Smithfield (now called West Smithfield to distinguish it from East Smithfield, Tower Hill) was the place of public execution. Here Sir William Wallace, and Mortimer, Earl of March, suffered death; here Walworth, the mayor, stabbed Wat Tyler; and here Jack Straw was hanged. Tournaments were held on this spot; Edward III. celebrated the deeds of Cressy and Poitiers by mimic feats of arms here; and here Richard II. gave a three days' tournament to celebrate his marriage. A more terrible page of history tells of the murders by way of burning which took place

Digitized by Google

here in the name of religion. Bartholomew Fair, so often mentioned in literature, was held at Smithfield. (See BARTHOLOMEW FAIR.) We find mention of a cattle market having been held here as far back as 1150. The corporation had official control over the market for above 500 years, dating from 1345.

Smithfield (W. Va.), **Engagement at.** This place, near the east bank of the Opequon, on the road from Charlestown to Bunker Hill, was the scene of many skirmishes and minor engagements during the Civil War, one of which, at least, deserves to be noted. On 28 Aug. 1864, after General Early had recrossed the Opequon from his engagement at Shepherdstown (q.v.), General Sheridan advanced his army from Halltown toward Charlestown and the Opequon. General Merritt's cavalry division marched by way of Lee Town, attacked Fitzhugh Lee's cavalry at that place, and drove it through the village, back through Smithfield, and across the Opequon. Next morning Merritt crossed the Opequon and was on his way to beat up Early at Bunker Hill, when he was met by Early, with the divisions of Ramseur and Gordon and driven back across the Opequon. There was an artillery duel across the stream and, the Confederate cavalry crossing, Merritt was driven from Smithfield and two miles beyond, in the direction of Charlestown. Early re-established his cavalry east of the Opequon, and marched his infantry back to Bunker Hill. Late in the day Ricketts' division of infantry came to Merritt's assistance and drove the Confederate cavalry from Smithfield and across the Opequon, and Merritt resumed his position at the Smithfield bridge. The Union loss was about 35 killed and wounded; the Confederate loss, 10 killed and 75 wounded.

E. A. CARMAN.

Smithson, James, founder of the Smithsonian Institution at Washington: b. Weston, Super-Mare, Somerset, England, about 1765; d. Genoa, Italy, 27 June 1829. His mother at the time of his birth was the widow of James Macie, a country gentleman of an old family. Smithson describes himself in his final will as «son to Hugh, first Duke of Northumberland, and Elizabeth, heiress of the Hungerfords of Studley, niece to Charles the Proud, Duke of Somerset.» Smithson seems himself to have observed no reticence about what he thought the true facts of his birth, but the name of Macie appears to have been imposed upon him from his youth by his parents, and his feeling that he must create for himself a position which his birth had denied him, is perhaps a reason for his subsequent bequest to the United States of the means which founded the institution bearing the name which he had later assumed, and which was the family name of Sir Hugh Smithson, the first Duke of Northumberland. It cannot but be supposed that something of this kind was in his mind when he wrote «My name shall live in the memory of man when the titles of the Northumberlands and the Percys are extinct and forgotten.»

Nothing material is remembered of his life at Oxford, where he entered under the name of Macie as a gentleman commoner in 1782, though he appears to have been partly occupied in chemistry, which was the scientific interest of his later life, and this at a time when the study of physical science was almost unknown in the university. He was graduated at Pembroke College with the degree of Master of Arts in 1786, and was admitted as a fellow of the Royal Society in the following year on the recommendation of Cavendish and other eminent fellows of the Society. Smithson published in all 27 scientific papers, eight in the Philosophical Transactions between 1791 and 1807, one in the 'Philosophical Magazine' and 18 in 'Thomson's Annals of Philosophy' between 1819 and 1825.

Professor F. W. Clarke gives the following view of the value of Smithson's scientific work: «To theory Smithson contributed little, if anything; but from a theoretical point of view the tone of his writings is singularly modern. His work was mostly done before Dalton had announced the atomic theory, and yet Smithson saw clearly that a law of definite proportions must exist, although he did not attempt to account for it. His ability as a reasoner is best shown in his paper upon the Kirkdale bone cave which Penn had sought to interpret by reference to the Noachian deluge. A clearer and more complete demolition of Penn's views could hardly be written to-day. Smithson was gentle with his adversary, but none the less thorough for all his moderation. He is not to be classed among the leaders of scientific thought; but his ability, and the usefulness of his contributions to knowledge, cannot be doubted.»

An important ore of zinc was named Smithsonite after him.

That he held a high place among his contemporaries is evident from the fact that the President of the Royal Society in a necrology for the year 1829 associated the name of Smithson with those of Wollaston, Young and Davy, saying that «he was distinguished by the intimate friendship of Mr. Cavendish, and rivaled our most expert chemists in elegant analyses.» He was, then, most noted in this connection, and exhibited an industry the more creditable to him, since he was at this time a man of large means. Of Smithson's later life little is known, but his declining years appear to have been tried by painful infirmities. He lived in these years principally in Paris and Genoa, and one gathers from his letters and from the uniform consideration with which he speaks of others, and from kind traits which he showed, the impression of an innately gentle nature, but also of a man who was renouncing, not without bitterness, the youthful hope of fame.

Smithson's will, dated from London 23 Oct. 1826, is a brief document leaving his property to a nephew, and in the case of the death of the nephew without leaving a child, he adds: «I then bequeath the whole of my property to the United States of America to found at Washington, under the name of the Smithsonian Institution, an establishment for the increase and diffusion of knowledge among men.»

The will was proved in the Prerogative Court of Canterbury, the value of the effects being sworn to be not over £120,000, a sum much larger in relative importance at the time than it would be now. The money appears to have come from his mother's family; there is, at least, no indication that any portion whatever of the Smithson bequest was derived from his Northumberland ancestry. It is not definitely ascertained why Smithson made the

Digitized by Google

JAMES SMITHSON.

FOUNDER OF THE SMITHSONIAN INSTITUTION.

Digitized by Google

Digitized by Google

United States his legatee, in which he is not known to have had any correspondent or friend.

Smithson was buried in the little English cemetery on the heights of San Benigno, the remains and monuments in which are now being removed by the Italian government to another location. The regents of the Smithsonian Institution, who had caused a tablet to be erected to him in the cemetery and in the church, on the removal of the cemetery, appointed one of their number, Doctor Alexander Graham Bell, to bring the remains from Genoa to Washington, where they arrived in the early part of 1904, being brought from New York to Washington, by order of the President of the United States upon a government vessel, and transferred from the Washington Navy Yard, under military and naval escort, to the Smithsonian building. Here they are momentarily reposing at the time this is written (March, 1904) until Congress shall make some fitting permanent disposition of them.

Consult: Rhees, 'James Smithson and His Bequest' in Volume XXI., Smithsonian Miscellaneous Collections; Langley, 'James Smithson' in 'The Smithsonian Institution, 1846–1896. The History of Its First Half Century' (1897).

S. P. Langley,
Late Secretary Smithsonian Institution.

Smithsonian Institution, The, an establishment at Washington, founded under a bequest of James Smithson (q.v.), couched in the following terms: "I bequeath the whole of my property to the United States of America to found at Washington under the name of the Smithsonian Institution an establishment for the increase and diffusion of knowledge among men."

In 1835, six years after Smithson's death at Genoa, Italy, the United States legation at London was notified that his estate, amounting in value to about £100,000, was held in possession of the Accountant General of the British Courts of Chancery. President Jackson, in a message to Congress, dated 17 Dec. 1835, notified that body, and after considerable debate a bill was passed, and approved on the 1st of July 1836, authorizing the President to assert and prosecute the claim of the United States to the legacy, which it is well to note was relatively far more considerable then than now, being greater than the endowment of any university or college in the country except Harvard at that time. The President selected as agent, Richard Rush, of Pennsylvania, who proceeded to London and entered a friendly suit in the Courts of Chancery, which was settled in two years. For eight years the matter was discussed in Congress, until on 10 Aug. 1846, an act which had passed both houses was approved by the President, in terms so broad as to allow for any future development of the Institution along any lines of intellectual advancement.

System of Administration.— The establishment consists of the President of the United States, who is the presiding officer *ex officio*; the Vice-President, the Chief Justice of the United States, and the members of the Cabinet. In addition to the establishment, there is provided a Board of Regents, by whom the business of the Institution is administered, composed of the Vice-President of the United States, the Chief Justice of the United States, three members of the Senate, three members of the House of Representatives, and six citizens, two of whom must be residents of the District of Columbia, and the other four from States of the Union, but no two from the same State. The Senatorial Regents are designated by the President of the Senate, and those representing the House by the Speaker of the House, the others being elected by Congress with the approval of the President. There is a secretary to the establishment, who is also secretary to the Board of Regents. Both the Congressional and citizen Regents have been selected from among the most distinguished Americans, and the roll of them for 50 years contains the names of many eminent public men and scholars. The Regents elect three of their number as an executive committee. The presiding officer of the Regents is the Chancellor, and is elected by the board, though the position is customarily held by the Chief Justice. The secretary of the institution, whose office is created by the fundamental act, is elected by the Regents and is the executive officer of the Institution. He is aided in his work by the assistant secretary, by the heads of the various bureaus of the institution, and by a large corps of scientific men.

The Institution occupies a building in the Mall, in the square known as the Smithsonian Park. It was planned by James Renwick, was begun in 1847 and completed in 1855.

The first secretary was Joseph Henry, distinguished in science for his epoch-making discoveries. It fell to his lot more than it could to any of his successors to determine what form the Institution should take, and his "Programme of Organization," adopted at the outset by the Board of Regents as the governing policy, has been found broad enough for all future time. Upon his death he was succeeded in 1878 by Spencer Fullerton Baird, the leading authority on the natural history of America, and the founder of the United States Fish Commission, and upon his death in 1887 the present secretary, Samuel Pierpont Langley, was elected. The terms of each of these three have been marked by some special feature: Henry developed the system of International Exchanges, and that of meteorological observations, which has since become the Weather Bureau; Baird devoted himself to the development of the Museum, secured the erection of a Museum building, gave much attention to explorations, and, as United States Commissioner of Fish and Fisheries, secured the construction of the exploring ship Albatross, which has been of such great advantage to American science.

In the term of the present secretary, the National Zoological Park and the Astrophysical Observatory have been established, and a new building authorized for the National Museum. Important donations and bequests have been added to the permanent fund, the most notable being the gift of Thomas G. Hodgkins, of Setauket, New York, in 1891, to the amount of nearly $250,000, the income of $100,000 of which was to be devoted to the investigation of atmospheric air. The Institution initiated the work devolving upon it by Mr. Hodgkins' bequest by offering various prizes, including one of $10,000 for the most important discovery, within a cer-

Digitized by Google

tain period, concerning atmospheric air. This unusually large prize stimulated much activity, and was awarded to Lord Rayleigh and Professor Ramsey for the discovery of Argon.

Objects of the Institution.— The broad purposes of the Institution are named in the words of the founder —«for the increase and diffusion of knowledge among men.» This was interpreted by Henry in the following words: «To assist men of science in making original researches, to publish them in a series of volumes, and to give a copy of them to every first-class library on the face of the earth.» It has supplied apparatus, made grants for experiments, and furnished information to many thousands of persons. The Institution also maintains a Table at the Biological Station at Naples. It initiated, from the income of its own fund, all of the activities imposed upon it by the fundamental act, though as these gradually grew beyond this income, they were greatly aided by appropriations from Congress, through which the various bureaus are at present maintained.

Publications.— There is no restriction as to the subject of publications, and they consist of memoirs upon archæology, astronomy, ethnology, botany, zoology, geology, palæontology, meteorology, magnetics, physics, physiology, and philology, and many other branches of investigation. They cover the following series: (1) ‘Annual Report of the Regents to Congress,’ of which the 58th, that for 1903, is now in press. Since 1884 the ‘Report of the Museum’ has been printed in a separate volume, Part II. (2) ‘The Smithsonian Contributions to Knowledge,’ 33 volumes in quarto, containing nearly 8,000 pages and many fine plates. (3) ‘The Smithsonian Miscellaneous Collections,’ in 45 octavo volumes, aggregating about 28,000 pages. A ‘Quarterly Issue’ of this series was begun in 1903. The foregoing publications are maintained at the expense of the original fund. (4) ‘The Bulletins of the National Museum,’ 52 in number, beginning in 1875. (5) ‘The Proceedings of the National Museum,’ including already over 1,500 separate papers embraced in 26 annual volumes, beginning in 1878. (6) ‘Contributions from the United States National Herbarium,’ of which 8 octavo volumes have been issued. This series was formerly published by the Department of Agriculture. (7) ‘The Annual Report of the Bureau of American Ethnology,’ beginning in 1879 and making a series of 20 illustrated volumes (aggregating 24 parts) in royal octavo. (8) ‘The Bulletin of the Bureau of American Ethnology,’ of which 27 numbers have appeared. (9) ‘The Annals of the Astrophysical Observatory,’ of which one quarto volume has been issued. In 1897 a royal octavo volume containing the history of the first half century of the Institution was published.

Library.— The publications noted above have been, since the beginning, distributed throughout the world, mostly to scientific and literary establishments and libraries; and in return the Institution has received the publications of like organizations, forming a collection of books which in the departments of publications of learned societies and periodicals, is one of the richest in the world. In 1865 the library was deposited with the Library of Congress and is now installed in a special hall upon the second floor of the new Library building. A working library of some 20,000 volumes has gradually grown up in connection with the Institution and its dependencies. Much attention was given to cataloguing and bibliography by the first assistant secretary of the Institution, Charles C. Jewett. Henry likewise was greatly interested in this subject, and it was due to his initiative that the Royal Society of London took up its catalogue of scientific memoirs, which has since developed into the International Catalogue of Scientific Literature. For this latter work the Smithsonian Institution is the representative of the United States.

The collection of objects of art was one of the original purposes of the Institution, though it has been to some extent held in abeyance. The valuable collection of prints and art books of George P. Marsh was, however, purchased, and a room devoted to prints and art books is set aside in the Smithsonian building.

National Museum.— The Smithsonian Institution is the only lawful custodian of «all objects of art and of foreign and curious research, and all objects of natural history, plants, and geological and mineralogical specimens belonging, or hereafter to belong, to the United States, which may be in the city of Washington.» Out of this provision in the fundamental act there grew the National Museum. The fundamental act was supplemented by an act of Congress, approved in 1880, which provides that «all collections of rocks, minerals, soils, fossils, and objects of natural history, archæology, and ethnology, made by the Coast and Interior Survey, the Geological Survey, or by any other parties for the government of the United States, when no longer needed for investigations in progress, shall be deposited in the National Museum.» The nucleus of the Museum was the cabinet of minerals of Smithson, the results of the Wilkes exploring expedition, and the national cabinet of curiosities which had been kept in the Patent Office. Its collections are kept in the greater part of the Smithsonian building and in the so-called National Museum building erected in 1881. Since that year over 5,000,000 persons have visited the Museum building, and nearly 3,000,000 persons the Smithsonian building. The Museum covers all departments of science, includes technology and American history, and numbers at the present time over 5,600,000 specimens. It has also been charged for the Smithsonian Institution with representation at various international expositions, whereby its methods have been made known and the spread of museums generally greatly furthered. The Institution has been represented at Philadelphia in 1876, at Berlin in 1880, at London, Louisville, and Cincinnati in 1883, at New Orleans in 1885, at Paris in 1889, at Chicago in 1893, at Atlanta in 1895, at Nashville in 1897, at Omaha in 1898, at Paris in 1900, at Buffalo in 1901, and at St. Louis in 1904, and has received many medals and diplomas upon these occasions. The Museum is strongest in everything that pertains to American archæology and ethnology, natural history and geology, being superior in these regards to any other. It has also very considerable collections in all branches of knowledge that lend themselves to study by specimens, and has by its methods of installation and label-

Digitized by Google

THE SMITHSONIAN INSTITUTION AT WASHINGTON, D. C.

Digitized by Google

Digitized by Google

ing been of great service to the museums of the world in pointing the way to improved methods. Many of these are due to George Brown Goode, assistant secretary in charge of the Museum from 1887 to 1896. Recently a Children's Room, which is intended to serve as a model of a small museum for interesting and instructing children, has been established.

International Exchanges.— The system of International Exchanges, begun in 1850, was designed for a free interchange of publications between men of science in various parts of the world. It established a body of correspondents which now numbers nearly 44,000, mostly abroad. In 1867 Congress assigned to the Institution the duty of exchanging for the benefit of the Library of Congress, 50 sets (a number since increased to 100) of all government publications, and in 1889 a treaty was entered into between the United States and other countries, in which this entire matter of exchange of scientific and government publications was fixed. This branch of the service, while not having a large space in the public eye, has been of great convenience to scientific men, of use in developing the libraries of this country, and indirectly has stimulated scientific research and publication, since by relieving scientific societies and individuals of the expense of exchanging their own publications, it has set large sums of money free for research.

Bureau of American Ethnology.— This bureau is an outgrowth of researches beginning early in the history of the Institution, whose first publication in the series 'Contributions to Knowledge' was on 'Ancient Monuments in the Mississippi Valley,' by Squier and Davis. In its present form the work of the Bureau was commenced in 1872 by Major J. W. Powell, at the request of the Commissioner of Indian Affairs, who desired trustworthy information concerning the affinities of the Indian tribes. In 1879 the Bureau was definitely organized under the direction of the Smithsonian Institution, and Major Powell was made director, serving in that capacity until his death in 1902. The Bureau has engaged in researches in the languages, habits, customs, tribal organization, government, myths and ceremonies of the American Indians, and it is proposed to summarize this material in a cyclopedia of American Indians, shortly to be published. It has also issued the voluminous publications already alluded to, which contain information of importance with regard to the political dealings of the United States government with the Indian tribes.

Astrophysical Observatory.— The Astrophysical Observatory was established in 1890 under the immediate direction of the present secretary. It has been devoted in the main, to researches in regard to that invisible portion of the solar spectrum which lies beyond the limit of the red. This work, first rendered possible by Mr. Langley's invention of the bolometer, has been carried still further, resulting in a great map of the infra-red solar spectrum completed in 1899, which extends our knowledge of the spectrum to many times that known to Newton. It is believed that these studies will prove of great practical importance, since they have to do with that region of the spectrum which includes the greater portion of the energy of the sun, which through its heat affects climate and crops. Important expeditions were sent out in 1900 and 1901 to observe the total solar eclipses of those years, and especially valuable results were obtained at that of 1900, including photographs of the solar corona of unexampled size and excellence.

National Zoological Park.— The National Zoological Park was established by Congress in 1890 at the initiative of the present secretary, to secure the preservation of such American animals as are upon the verge of extinction, and also for the pleasure and instruction of the people. The park is situated upon Rock Creek, two miles north of the centre of the city, and has an area of 167 acres, being four times as large as the Zoological Garden at London. It is amply supplied with water, and its surface is of a varied and picturesque character. The collection comprises about one thousand animals, mostly American species.

Summing up what has been said about the Smithsonian Institution, we see that it occupies the exceptional position of a ward of the government, its regents expending its own income, which is largely supplemented by direct government grants for its museum and other bureaus; while through its extended system of publications, its library and its means for encouraging research and diffusing knowledge, through a body of over 30,000 correspondents abroad and approximately half that number at home, it occupies its actual place in the scientific activities of the day.

See 'The Smithsonian Institution, 1846–96, the History of its First Half Century,' edited by George Brown Goode.

S. P. Langley,
Late Secretary Smithsonian Institution.

Smithsonite, in mineralogy a name applied to the carbonate of zinc as it occurs in nature. It occurs in crystallized forms of the rhombohedral system, with perfect cleavage. Also as reniform, botryoidal, and stalactitic masses; and again granular to compact massive or earthy. In this latter form it is impure and varies from grayish-white to dark gray-brown, brownish-red, or brownish-black, and is known as "dry bone" by American miners. In the purer forms it has a vitreous lustre inclining to pearly, with the color varying from white to grayish, greenish, or brownish, a white streak, and a translucent to almost transparent character. Its hardness is 6 per cent the scale, and its specific gravity 4 to 4.45. In the United States it occurs in New Jersey, near Franklin Furnace, Pennsylvania, Wisconsin, Minnesota, Missouri, Arkansas, and other States.

Smithwork. See Metal Work.

Smoke, the exhalation or visible vapor that arises from a substance burning. In its more extended sense the word smoke is applied to all the volatile products of combustion, which consist of gaseous exhalations charged with minute portions of carbonaceous matter or soot; but, as often used in reference to what are called smoke-consuming furnaces, the term is frequently employed to express merely the carbonaceous matter which is held in suspension by the gases.

Digitized by Google

Smoke Nuisance. Various measures have been taken both in England and the United States to overcome the evil effects of coal smoke, especially in large cities. In 1875 a Public Health Act was passed in England to prevent nuisance from smoke in towns which provided that all fireplaces, furnaces and chimneys (exclusive of the chimneys of a private dwelling) must be so constructed as to consume their smoke, under a penalty not exceeding $25 nor less than $10, on a second conviction $50. Similar laws apply to railway locomotives and river steamers. In the United States various laws have been passed by State legislatures and municipal bodies. But these enactments have only been partially successful. There are many practical difficulties in the way of consuming smoke, but experience has shown that none of them are insuperable. The principle involved is that of mixing air with the combustible vapors and gases generated by the action of heat on the fuel, so that by virtue of a due supply of oxygen they may be made to burn with flame, and become entirely converted into incombustible and invisible vapors and gases. Consult Popplewell, 'Consumption of Smoke.'

Smoke-tree, an arborescent shrub (*Cotinus,* or *Rhus cotinus*) indigenous to Europe, and also called Venetian Sumach; or the similar American species (*Cotinus cotinoides*). They are shapely, tall and much branched and have oval leaves and terminal, large, loose panicles of greenish, polygamus 5-parted flowers. These are chiefly abortive, and the long pedicels become very plumose in fruit, and seem to smother the plants as by smoke, with their feathery soft masses, which are pale green or reddish in hue. The soft orange-colored wood yields a valuable dye-stuff called young fustic, and the leaves of the European species are used in tanning.

Smokeless Powders are the modern explosives which have replaced black gunpowder for use as propellents in guns. Such powders are styled smokeless because they give rise to comparatively little smoke when fired. This is due to the fact that the products of their combustion are practically all gaseous at the temperature of explosion. Black gunpowder gives rise to much smoke when fired because 57 per cent by weight of the products of its combustion form solid matter on cooling and therefore precipitate rapidly out of the atmosphere. While smokelessness or smoke-weakness offer, for many military purposes, the distinct advantages that they permit of a clear atmosphere being maintained during an engagement; that they prevent the enemy from readily locating the spot from which a shot was fired; and that they do not readily foul the bores of the guns in which they are used, these modern powders possess the still more important advantage that, weight for weight, they are much more powerful than black gunpowder. In consequence of this we not only by their use are able to impart higher velocities to our projectiles and thus secure flatter trajectories, greater ranges, and better penetrations than were before possible, but the soldier or the ammunition wagon now carries less weight for the same number of rounds of ammunition or a greater number of rounds of ammunition for the same weight. The earliest experiments with smokeless powder were made by the English chemist, Howard, in 1800, when he tested the properties of his newly discovered mercuric fulminate and found that though this violent agent produced little smoke, imparted a low velocity to the projectile and but a slight recoil to the piece, it burst the chamber and demonstrated its unfitness to compete with gunpowder as a ballistic agent, though it has found a limited use, when mixed with solid diluents which act as restrainers, in ammunition for parlor rifles, and it is noticeable that when firing this ammunition there is little smoke and a scarcely audible report attending the discharge.

The next step was taken when, soon after the discovery of gun cotton, in 1845, attempts were made to use this material, in its fibrous condition, as a propellent. These experiments were made in Germany, France, and England, while a very extended series were carried on by Major Mordecai of the United States Army, at the Washington Arsenal; but the material, owing to its fibrous form and the imperfection in its manufacture proved too brisant and too irregular in action and it was so unstable as to undergo dangerous decomposition in storage so that it was not adopted. The material had, however, been proved to possess so many valuable qualities that it continued to be the subject of study by many chemists and especially Baron von Lenck of Austria and Sir Frederick Abel of England, the latter devising a method of purification by reducing the gun cotton to a pulp or dust. Besides affording a means for the better washing of the guncotton this pulverulent condition permitted of the dust being formed into grains and a patent was issued to Abel in 1866 for the production of powder by agitating this pulp in a vibrating vessel, with or without a binding material, whereby the pulp was formed into granules of different sizes which were subsequently sorted. The grains thus produced were quite soft, easily crushed when dry and readily absorbed water. In 1882 Reid and Johnson of England improved the process by moistening the dried grains with a volatile solvent which on evaporation left the surfaces so hardened as to better resist crushing and the absorption of water from the atmosphere. During this time superficially hardened soft grained powders composed of mixtures of different cellulose nitrates or nitro-lignins together with unnitrated material and nitrates such as sodium or barium nitrates came into use as smokeless sporting powders under the names among others of Schultze, E. C., Brackett's, J. D., and American Wood powders. These powders were, from the method of their manufacture, quite bulky and are, therefore, also classified as bulk powders.

In 1886 Vielle in France produced the first military smokeless powder of the modern class, by gelatinizing a mixture of cellulose nitrates only, or these mixed with barium and potassium nitrates as oxidants and sodium carbonate as a neutralizer, with ether-alcohol or some other solvent. When the solids and the solvents were intimately mixed and gelatinization was complete the plastic mass was rolled out into sheets, cut into strips and dried, by which a dense powder, which was hardened throughout, was produced. This powder was styled Poudre B when it consisted of cellulose nitrates only or Poudre BN when it consisted of these nitrates

Digitized by Google

mixed with the inorganic salts named above. In 1888 Nobel in France discovered that by the aid of camphor or benzene he could effect the solution of as much as 40 per cent of nitro-cotton in nitroglycerin, forming a plastic mass which when rolled out into sheets and dried formed a mass resembling india rubber. This was cut in blocks or strips or flakes and was known as ballistite. As adopted in Italy the plastic mass was squirted through spaghetti machines forming cords which were cut into the desired length and the powder in this form was known as Filite.

In 1889 Abel and Dewar in England made a plastic mass from nitroglycerin, nitro-cotton, gun cotton and tannin, dextrine or vaseline, and as it was made up into cords, it was called Cordite. In making this powder the gelatinization was effected by using acetone as a solvent, the mixture being kneaded to a dough in a water-jacketted kneading machine. The gelatinized mass was compacted in a mold by a preliminary press and the mold transferred to a spaghetti machine, or stuff press, where the explosive was squirted into strands. As these strands issued they were reeled on bobbins which were placed in the drying house so as to drive off the solvent. When dried the product of 10 pressings was wound from ten one-strand reels on to one 10-strand reel and then the cordite on six 10-strand reels was wound on a drum making a cord of 60 strands, which when cut in short lengths formed the 30.5 grains charge for the magazine rifle. For higher calibres the cords as squirted were of larger diameter and were cut into desired lengths as they issued from the stuff press, dried and made up into bundles or fagots. Cordite is an elastic rubber-like mass with a light to dark-brown color. Other nitroglycerin-cellulose nitrate powders are amberite, Maxim's powder, Maxim-Schupphaus powder, Leonard's powder, P. P. G., Peyton's powder, and German smokeless powder. These powders differ in the proportions of their ingredients or in containing blended cellulose nitrates, or else castor oil or lycopodium or urea in addition to the other ingredients or they differ in the form of the grain. Thus Maxim perforates his grain, making it a tube, or he makes several longitudinal perforations, getting "multiperforated grains," while Gathmann cuts slots in the sides of the multiperforated grain to serve as vent holes through which the gases accumulated in the longitudinal canals may escape, and the breaking up of the grains by the accumulated pressure be prevented

In 1890 Richard von Freeden of Walsrode, Germany, discovered if gelatinized cellulose nitrate was exposed to water it underwent a kind of coagulation and division into small lumps which latter was promoted by stirring, and he based upon this a method of manufacture by which dense small grained powders that are hardened throughout could be produced. This product is known as Walsrode powder. Later Dupont accomplished the same result by throwing his pulped cellulose nitrate into a churn containing the gelatinizing solvent mixed with a large volume of water and containing potassium and barium nitrates in solution, and thus produced the Dupont smokeless powder. Similar to these, and likewise used for sporting purposes, are the Oriental and Hazard smokeless powders. In 1890 Charles E. Munroe pointed out that all powders, either gunpowders or smokeless powders made up to that time, consisted of mixtures of different materials, even the straight cellulose nitrate powders being made of mixtures of different nitrogen contents, and he set forth the novel principle of powder making that the finished powder should consist of a single chemical substance in a state of chemical purity and this was realized in the smokeless powder which he styled Indurite and which was popularly known as U. S. Naval smokeless powder. As made it consisted only of cellulose nitrate of the highest nitration in an indurated condition and resembled ivory. It was made in the form of flakes for small arms and in the form of macaroni for large calibres. The smokeless powder for the United States navy and army as made to-day consists of cellulose nitrate of medium nitration made up in perforated cylindrical grains which are translucent and the color of amber. The quantity of smokeless powder produced in the United States in the census year 1900 was 3,053,126 pounds, having a value of $1,716,101.

Bibliography.— Longridge, 'Smokeless Powder and Its Influence on Gun Construction' (1890); Moch, 'La poudre sans fumée et la tactique' (Paris 1890); Rigg and Garvie, 'Modern Guns and Smokeless Powder' (1892); Pouteaux, 'La poudre sans fumée et les poudres anciennes' (Paris 1893); Guttmann, 'The Manufacture of Explosives' (1895); Munroe, 'Development of Smokeless Powder' (1896); Bernadou, 'Smokeless Powder, Nitrocellulose and Theory of the Cellulose Molecule' (1901); Daniel, 'Dictionnaire des matières explosivs' (Paris 1902).

CHARLES E. MUNROE,
Columbian University, Washington, D. C.

Smoky Hill River, or **Smoky Hill Fork**, the source is in eastern Colorado, and it flows into the State of Kansas through Grove, Trego, Ellis, Russell and Ellsworth counties. About 10 miles west of Abilene unites with the Solomon River, and forms the Kansas River. It is 400 miles long and traverses a prairie region noted for its fertility.

Smoky Mountains, or **Great Smoky Mountains**, on the boundary of North Carolina and Tennessee; a part of the Appalachian system. The highest peaks are Mount Guyot, 6,636 feet high and Clingman's Peak 6,660 feet high. This mountain is the scene of one of Mary Noailles Murfree's (q.v.) stories, 'The Prophet of the Great Smoky Mountain.'

Smoky Quartz, a smoky-yellow to brown and black variety of the mineral quartz. It is often transparent and then yields gems of considerable beauty. Cairngorm (q.v.) is a yellowish variety. Morion is nearly black. Magnificent crystals weighing as much as 250 pounds have been found in Switzerland; very choice crystals, sometimes of large size, occur in Maine, North Carolina, Montana and Colorado.

Smolensk, smō-lĕnsk', Russia, (1) Capital of Smolensk, on the Dnieper, 250 miles southwest of Moscow. It occupies steep slopes, rising from the river's edge, and is surrounded on the left bank by a wall; on the right bank by earthworks. A large open square occupies the centre of the town. There is a cathedral of the 17th and 18th centuries, an episcopal palace, semi-

Digitized by Google

nary, gymnasium, schools, three public libraries, a museum containing valuable antiquities, theatre, and several philosophical and scientific societies. It has manufactories for linen, leather, hats, carpets, and soap. Trade is chiefly in corn and hemp. Smolensk is a place of some antiquity and was an important town in the 9th century; a strong fortress in the 14th century and in 1812 was taken from the Russians by Napoleon and destroyed by fire. Pop. 46,900. (2) The government contains 21,632 square miles. It is largely covered by forests. Flax and hemp are the chief crops, besides the cereals and potatoes. The mining of phosphorite is an important industry, and also the manufacture of paper. Swine are raised. Pop. 1,671,000.

Smollett, Tobias George, English novelist: b. 1721; d. near Leghorn, Italy, 17 Sept. 1771. He belonged to a family of Scotch lairds seated at Bonhill, near Dumbarton, in the picturesque valley of the Leven. His grandfather, Sir James Smollett (1648-1731) represented Dumbarton in the old Scots' parliament and helped frame the act of union with England in 1707. The laird's youngest son, Archibald, weak and improvident, married Barbara Cunningham, a proud and ill-tempered woman with little or no fortune. Of this marriage were born three children, of whom the last, Tobias George, was christened on 19 March 1721. Two years later the boy's father died, leaving wife and children to the charity of the old knight. After the usual schooling at Dumbarton, the future novelist was apprenticed to John Gordon, a physician and apothecary at Glasgow, and was permitted at the same time to attend lectures at the university, where he seems to have learned his Latin and Greek. In his eighteenth year he wrote a play called 'The Regicide,' based like Rossetti's 'King's Tragedy,' upon the murder of the first James of Scotland.

In 1739, Smollett set out for London, tragedy in pocket, to make his fortune by literature. The play was submitted to Lyttelton, the patron of letters, by whom it was perhaps passed on to Garrick. But it never reached the stage, for which it was ill-adapted, notwithstanding the author's loud denunciation of those who thought so. Smollett now entered the navy as a surgeon's mate and took part in the expedition under Admiral Vernon against Carthagena and the sea power of Spain in America. While at Jamaica, he fell in love with a beautiful creole, Nancy Lascelles, daughter and heiress of an English planter, whom he married then or after his return to London. In 1744 he settled in Downing street and began the practice of surgery. From time to time he wrote odes and satires. His 'Tears of Scotland,' occasioned by the cruelties of the English at the battle of Culloden, awakened popular sympathy for "helpless Caledonia." In 1748 he suddenly came to his fame with 'Roderick Random,' a story of adventure on land and sea following in general outline the career of Smollett himself from the day he left Leven-water. With half its literary merits, it would have been read for its daring personalities and fierce exposé of the dreadful condition of the British navy. Its popularity was quite sufficient to float the next year an edition of the unfortunate 'Regicide.' At the same time appeared Smollett's translation of 'Gil Blas.' A trip to France furnished material for 'Peregrine Pickle' (1751), containing attacks so brutal on Lyttelton, Garrick, Akenside, and Fielding, that the author modified or cut them away for a second edition.

In 1750 Smollett obtained the degree of M.D. from the University of Aberdeen, and tried to establish himself at Bath. Failing in this last attempt to gain patients, he returned to London, and took an old Elizabethan mansion at Chelsea, where he resided for the rest of his life in England. During the next ten years he performed, single-handed or by the aid of assistants, an enormous amount of work. The mills never stopped grinding. The 'Adventures of Ferdinand Count Fathom' (1753) was succeeded by a translation of 'Don Quixote' (1755) and a 'Compendium of Voyages' (1756) in seven volumes. A play called the 'Reprisal or the Tars of Old England' Garrick brought out for him at Drury Lane early in 1757. For a complete 'History of England' in five volumes (1757-58) he required only 14 months. Revised, enlarged, and issued in sixpenny parts, Smollett's history threatened to drive Hume out of the market. Under Smollett's supervision appeared also 'The Present State of All Nations' (1764) in eight volumes and a translation of the entire works of Voltaire. On the founding of the *Critical Review* in 1756, he assumed the editorship. For this monthly he wrote many slashing articles, one of which led to a short imprisonment for defamation of character. He also edited *The British Magazine,* where first appeared as a serial his 'Adventures of Sir Launcelot Greaves' (1762). This manner of publication was an innovation. Smollett's work as editor closed with the short-lived *Briton* (1762), an organ of the Tory party.

Under the pressure of work and grief for the loss of a daughter, Smollett's health broke down. The years 1762-65 he passed with his wife on the continent, mainly in southern France and Italy. On his return he published a book of 'Travels' (1766), which, despite Sterne's ridicule of it in the 'Sentimental Journey,' displays much common sense. The 'Travels' out of the way, Smollett visited Edinburgh, where his mother was still living, and then went on to Glasgow, and the romantic scenes of his childhood. A brief sojourn at Bath for Christmas (1766), and Smollett was back to London at his desk, writing 'The History and Adventures of an Atom' (1769), a savage satire on English politics since 1754. Completely broken in health after this effort, he hastened to Italy, where he settled in a villa near Leghorn. There he wrote his last novel, 'The Expedition of Humphry Clinker' (1771), based upon his recent tour of England and Scotland. and planned, it would seem, while at Bath. He saw it in print but never lived to know of its great reception. He died 17 Sept. 1771, and was buried in the English cemetery at Pisa. Two years after his death appeared his characteristic 'Ode to Independence.' His wife, to whom he was fondly attached, remained at Leghorn, where she died in some distress about 1785.

Digitized by Google

Smollett was a man of rugged honesty. His irritable temperament, about which so much has been written, showed itself in his books rather than in his intercourse with friends. Visitors at Chelsea were surprised at his «polished and agreeable manners and the great urbanity of his conversation.» His cynicism had the saving grace of humor. When he began his 'History of England,' he was a Whig; but he turned Tory during the process of composition, as the Whig ministers, on close examination, proved to be «a set of sordid knaves.» His histories, compendiums, and translations, though good narrative, have no further value. As a novelist, he seems, on first sight, to have added nothing to the art of fiction. Instead of beginning with Richardson and Fielding, he went back, as he said himself, to the loose narrative of Le Sage, which admitted of digressions and episodes, without number. For a consideration, he incorporated into 'Peregrine Pickle' the memoirs of a notorious lady of quality. He held too closely, it is said further, for the highest art, to his own experiences. His best known novels are not much more than autobiographies. All this may be granted. But there is the other side. In his early years, he cultivated verse-satire. Had he come a generation or two earlier, he would have been of the company of Pope and Dryden. Coming after Richardson, he was the founder of the satirical novel. His work has immense scope, for it includes men, manners, art, and politics at home and abroad. Of his successors, only Disraeli may be compared with him. He wrote our first novel of the sea and is thus a forerunner of Cooper. In 'Count Fathom' may be discovered the beginnings of the Gothic romance afterwards practised by Horace Walpole and Mrs. Radcliffe. And 'Humphry Clinker,' «the most laughable story,» said Thackeray, «that has ever been written since the goodly art of novel-writing began,» brought into fiction that spirit of fun which later times have associated with Dickens.

Bibliography.—Among good recent editions of Smollett's works may be cited Saintsbury's (12 vols. London 1895), and Henley's (12 vols. London 1899-1901), both of which have introductory essays. The 'Works' with a memoir by the author's friend, Dr. John Moore (8 vols. London 1797) was reissued under the editorship of J. P. Brown in 1872-3. The most interesting of recent biographies is the 'Life' by D. Hannay in the 'Great Writers Series' (London 1887). Scott has a notable essay prefixed to Smollett's novels in the 'Novelists' Library' (London 1821), and Thackeray included him among the 'English Humourists.'

WILBUR L. CROSS,
Professor of English, Yale University.

Smoot, Reed, American Mormon leader: b. Salt Lake City 10 Jan. 1862. He was educated at Deseret University, Salt Lake City, and at the Brigham Young Academy, Provo. He entered business and became prominent in various industrial enterprises in Salt Lake City and Provo. In 1895 he was appointed one of the presidency of the Utah Stake of the Church of Jesus Christ of the Latter Day Saints, and in 1900 an apostle of that church. In 1903 he was elected to the United States Senate, but his right to a seat there was contested on the ground that as a high official of the Mormon Church he officially sanctioned polygamy in violation of the laws of the State of Utah, and an oath taken by the members of the Mormon hierarchy said to be inconsistent with loyalty to the national government and Constitution.

Smuts. See FUNGI; DUST-BRAND.

Smyrna, smĕr'na (Turkish, IZMIR), Asia Minor, an ancient city and important seaport, on the west coast of the pashalic of Anatolia, at the head of the Gulf of Smyrna (a sheltered inlet of the Ægean Sea extending inward for about 45 miles). A broad quay and artificial harbor, the former traversed by a tramway, borders the sea-front. The city is divided into four quarters—Frank, Turk, Greek, and Armenian. The public buildings include the palace of the governor, a large barrack, a number of mosques, and several Greek, Armenian, Roman Catholic, and Protestant places of worship, the British consular chapel, two English and an American churches. There is a British seamen's hospital here, for which a new building was erected in 1897. New waterworks were completed in 1898. Smyrna has been for centuries the most important place of trade in the Levant. This trade is carried on partly by shipping, partly by caravans from the interior, and is now supplemented by two railways having a length respectively of 304 and 165 miles. The commerce is increasing rapidly. The chief imports are cotton and woolen manufactured goods; colonial goods, mostly coffee and sugar; iron, coal, hardware goods, leather, timber, glass-ware, butter and margarine, drugs, jute bags, petroleum, etc. The principal exports are raisins, figs, valonia, cereals, tobacco, gum-arabic, opium, carpets, cotton, wool, liquorice, olive-oil. Smyrna has been frequently injured by earthquakes and has also suffered severely from fire. The climate is variable, and fever (usually of a mild type) is prevalent. There are conflicting accounts of the origin of this city; the most probable is that which represents it as an Æolian colony from Cyme. About 688 B.C. it fell into the hands of the Ionians of Colophon. This earliest city, called by the Greeks Old Smyrna, was situated on the banks of the Meles, on the northeast side of the Hermæan Gulf (now the Gulf of Smyrna). It laid claim to the honor of being the birthplace of Homer, and its coins bore his image. This old city was abandoned, and was succeeded by a new town on the southeast side of the gulf (the present site), which was said to have been built by Antigonus, and enlarged and embellished by Lysimachus, both generals of Alexander the Great. It was laid out with great magnificence, and adorned with several splendid buildings, among which was the Homereum, where the poet was honored as a god. It soon became one of the greatest and most prosperous cities in the world. It was especially favored by the Romans on account of the aid it lent them in the Syrian and Mithridatic wars. In the civil wars it was taken and partly destroyed by Dolabella, but it soon recovered. It is one of the two among the seven churches in Asia which Saint John addresses without rebuke, and it was the scene of the labors and martyrdom of Polycarp. In the 13th century

Digitized by Google

only the ruins of its former splendor were left; but after the Turks became masters of the country it began to revive, and it is now the most flourishing city of Asia Minor. Pop. about 200,000, fully half being Greeks.

Smyrna Camp Ground, Engagement at. On the night of 2 July 1864, Gen. J. E. Johnston abandoned Marietta for a new position ten miles south, covering the railroad and his pontoon-bridges, with an advanced position at Smyrna Camp Ground, six miles below Marietta. Sherman pushed forward from Marietta on the morning of the 3d, hoping to catch Johnston before he could get his army across the Chattahoochee, and was much surprised when the head of Thomas' column ran up against strong works at Smyrna Camp Ground, covering the wagon-road and railroad. The army was deployed, and there was heavy skirmishing. On the 4th Gen. Dodge, commanding the Sixteenth corps, moved out on the Ruff Station road and developed a Confederate position of two intrenched lines, strongly held. Dodge intrenched. At 4 P.M. a charge was made by three regiments of Veatch's division, under Col. E. F. Noyes, and three regiments of Sweeny's division, resulting in the capture of Johnston's first line of works and over 100 prisoners, with a Union loss of 140 killed and wounded, Noyes losing a leg. During the night Johnston abandoned his advanced position and drew back all his army and trains to the intrenched line covering the railroad bridge. Sherman closed up against him and was met by a heavy and severe fire, then threw forward both flanks, and by morning of the 6th held possession of the river above for 18 miles, as far as Roswell, and ten below to the mouth of the Sweet Water. On the 9th Sherman crossed a part of his army over the Chattahoochee, near Roswell, and that night Johnston abandoned his position, crossed to the south side of the Chattahoochee, burned the railroad bridge and his pontoon and trestle bridges, and took position in the outer defenses of Atlanta. Consult 'Official Records,' Vol. XXXVIII.

E. A. Carman.

Smyth, smīth or smĭth, **Charles Piazzi,** English astronomer: b. Naples 3 Jan. 1819; d. 21 Feb. 1900. He was employed at the observatory at the Cape of Good Hope (1835–45); was astronomer royal for Scotland (1845–88); and retired on a pension in 1888. He made a most thorough examination of the great Egyptian pyramid and was led to the conclusion that the structure was raised under direct inspiration of God, and that therein were deposited revelations of the great truths of physical nature. He wrote 'Our Inheritance in the Great Pyramid' (1864); 'Life and Work at the Great Pyramid' (1867); 'Antiquity of Intellectual Man' (1868); etc.

Smyth, Egbert Coffin, American Congregational clergyman and author: b. Brunswick, Maine, 24 Aug. 1829: d. Andover, Mass., 12 April 1904. He was graduated from Bowdoin College in 1848, and from Bangor Theological Seminary in 1853. The following year he became professor of rhetoric at Bowdoin and two years later professor of natural and revealed religion. In 1862–3 he studied in Germany when he was called to Andover as professor of ecclesiastical history, and has been for more than 40 years identified with the growth of Congregationalism. From 1886 to 1892 he was involved as editor of the 'Andover Review' in a religious controversy with the more orthodox clergymen of the denomination, but was upheld by his colleagues and the progressive members of the church at large. He is the author of several important works upon theology, the best known among which are: 'The Divinity of Jesus Christ' (1893); 'From Lessing to Schleiermacher, or From Rationalism to Faith' (Boston Lectures 1870), and 'Influence of Jonathan Edwards on the Spiritual Life of New England' (1901).

Smyth, Samuel Phillips Newman, American Congregational clergyman and author, brother of E. C. Smyth (q.v.): b. Brunswick, Maine, 25 June 1843. He was graduated from Bowdoin College in 1863, and at Andover Theological Seminary in 1867. He was called to the First Congregational Church of Bangor, Maine, and in 1882 to the First Congregational Church of New Haven, Conn. He is the author of: 'Old Faiths in New Lights'; 'The Orthodox Theology of To-day'; 'The Morality of the Old Testament'; 'Christian Ethics'; 'Through Science to Faith'; and other books.

Smyth, William Henry, American engineer and inventor: b. Birkenhead, Cheshire, England, 16 May 1855. He was graduated from the Mechanic's Institute and Yorkshire College of Technology, Leeds, came to the United States as a consulting engineer and has practised in this capacity since 1879. Among his important inventions are a machine for making, soldering, testing and beading cans, 1889–1903; pneumatic apparatus 1896; hydraulic and chain bucket dredger, 1898; deep well pump, 1903, etc.

Snail-bore. See Drill.

Snails and Slugs, names restricted in their original application to gasteropodous mollusks typifying the families *Helicidæ* and *Limacidæ* respectively, but now used in a much wider sense. The terrestrial and fresh-water snails and slugs represent the order *Pulmonata,* characterized by the presence of a lung-sac formed by a fold of the mantle for the respiration of air and opening by a conspicuous pore situated at the mantle border, usually on the left side. They are always asymmetrical, but have the visceral loop of the nervous system straight and the ganglia concentrated in a ring about the œsophagus. All are hermaphroditic, though the structure of the complex genital organs varies greatly. A shell is generally present, though absent or rudimentary in the slugs, and is usually dextral. Except in the brackish water *Amphibolidæ* of New Zealand there is no operculum. Within the mouth is the jaw, usually single and placed just behind the upper lip, but in some forms there are accessory pieces. Both the jaws and the teeth on the lingual ribbon or odontophore present an astonishing variety of form which is characteristic of genera and species. With these organs the food, almost exclusively vegetable, is cut and rasped. Scarcely any of the *Pulmonata* are marine, and very few live in even brackish water, though a large number inhabit fresh water and some the depths of lakes, from which they never come to the surface to breathe air, but take water into the lung, which has therefore secondarily assumed the function of a gill. The great number of species are arranged in

Digitized by Google

two sub-orders: The Basommatophora, which have non-retractile tentacles with the eyes situated at their bases and male and female organs opening separately, and the stylommatophora, with retractile and often invaginable tentacles, two of which bear the eyes at their tips, and the genital orifices generally united. Each sub-order includes numerous families, upon the exact number and arrangement of which authorities are not yet fully agreed.

As examples of the sessile-eyed snails the following may be selected, the generic names employed being in most cases in the less restricted sense. *Melampus lineatus* represents the family *Auriculidæ,* and is one of the few marine species, inhabiting the salt marshes along the coast in great numbers. The shell is solid and sub-oval, with a polished surface of a handsome brown color marked with reddish bands. The *Limnæidæ* are the common pond-snails, which have a very delicate fragile shell and the orifice of the lung protected by a special lobe. The species are very numerous and abound everywhere in sluggish fresh waters. *Planorbis* has the shell rolled in a flat spiral and thicker than usual in the family. A number of species are common in the sluggish rivers and streams of the United States, where they may be found attached to stones along with masses of their eggs. *Limnæa* is the type genus and is known by its rather slender, dextrally spiral, delicate shell with a large aperture. *L. stagnalis* is abundant in ponds, and other species are particularly well represented in the northern States and Canada. Their eggs may be found imbedded in little packets of transparent jelly attached to aquatic plants throughout the summer. During seasons of drought these and other water snails burrow into the mud or close the aperture of the shell by a membrane formed of secreted mucus. They are strictly vegetarian and make useful and interesting inmates of aquaria. *Physa heterostropha* is equally common and has similar habits, but the very delicate shell is sinistral. *Ancylus* includes the fresh-water limpets, our species being very small, with flattened conical shells, which are found attached limpet-like to stones and plants in ponds. This group includes no slugs.

The stalked-eyed snails are more numerous and important. *Glandina truncata* of fresh-water swamps of the Southern States belongs to the family *Testacellidæ,* which are remarkable because of their carnivorous habits and the absence of a jaw. This species has a well-developed shell, but the related genus *Testacella* of Europe is a slug, bearing the small disk-like shell at the posterior end of the body. It attacks and devours earthworms and slugs, but also eats decaying animal matter. The true slugs belong to the family *Limacidæ* in which the shell, if present, is usually buried in the mantle or else is a plate covering only a small portion of the animal. The visceral hump of the snails is absent or little developed in the slugs. The body is generally oval or oblong, elongated, from one to three inches in length. The creeping disk, or sole of the foot, extends the whole length of the animal, but, like snails, slugs frequently raise their heads and move their tentacles in search of objects above them. They often climb trees, and can lower themselves to the ground by the accumulation of mucus at the extremity of the tail hardening into a thread, and as they crawl they leave a slimy track. They oviposit in moist places in spring and summer, often at roots of grass; the eggs are laid in strings, each in a separate gelatinous envelope. Slugs are found in moist places in the woods, damp cellars, etc., and are especially partial to decaying wood, upon which they in part feed. But their chief food consists of the tender leaves and shoots of plants, and the garden species often inflict considerable damage upon lettuce, celery, etc., but much less in this country than in Europe. They may be checked by sprinkling wood ashes, lime or soot about young and tender plants or in cellars by sprinkling salt about their haunts. They are active at night and conceal themselves by day. During the winter they hibernate. Among the genera are *Arion, Agriolimax, Limax* and its numerous subdivisions. Several of our common garden and cellar species are European importations. *Limax maximus* is very common and 4 or 5 inches long, of an ashy gray color with black stripes and spots. It is sometimes eaten in England. *L. campestris* is very common in woods and meadows. It is much smaller and uniform pale gray or brown. *Arion fuscus,* a European species, has been introduced into this country in the neighborhood of Boston. The shell is concealed and very imperfect and there is a large triangular mucous pore near the posterior end. The eggs are said to be phosphorescent. *Philomycus carolinensis* is a large slug found under logs and bark in woods and which is often placed in a distinct family. There is no trace of a shell and the mantle covers the entire back.

The *Helicidæ* or family of true snails is an immense one, the typical genus alone in its unrestricted sense embracing about 5,000 species. They abound in moist places and have very similar habits the world over. They feed chiefly on vegetable substances, though they are very indiscriminate in their appetite and even devour the dead of their own kind. The mischief which they do to garden crops is too well known; and gardeners lay down cabbage leaves and the like to attract them, in order that they may be destroyed. Snails delight in warm, moist weather; in dry weather, their chief time of activity is during the night, and they hide themselves by day; but after rain they come forth at any hour in quest of food. At the approach of winter or in very dry weather they close the mouth of the shell with a membrane (epiphragm), formed by the drying of the mucous substance which they secrete, and become inactive and torpid. Snails retreat into crevices for the winter, or into holes which they make in the earth, and which are roofed over with earth, dead leaves, etc., agglutinated by secreted mucus. The eggs are deposited in moist earth, the snails often burrowing beneath the surface for this purpose and they have no jelly but only a slightly adhesive covering. Among the most plentiful of our native species are *Helix albolabris* and *H. alternata* and the minute *Zonites milium* (not closely related) found everywhere in damp woods. Several of the large European species have been introduced. The great vine snail, or edible snail (*Helix pomatia*), a European species, was considered by the ancient Romans one of their table luxuries. In some countries, as Switzerland and parts of France, they still form a considerable article of commerce. They, to-

Digitized by Google

gether with *H. aspersa*, are fed by thousands in places called «escargatoires,» which are made on purpose for them. Preserved snails are imported into the United States for table use, and the demand has increased sufficiently to induce a few persons to inaugurate the business of raising them, particularly in California. On account of its large size and gregarious habits the European *H. pomatia* is best suited to this purpose.

Another family of water snails (*Paludinidæ*) belongs to a quite different division of the *Gasteropoda*, the order *Prosobranchiata*. In these forms the usually single ctenidium is placed anterior to the heart, and the visceral nervous loop is twisted into a figure 8. The order is a very extensive one, most of the members of which are marine. With the *Valvatæ, Ampullariæ*, which are related fresh-water forms often placed in distinct families, the species of *Paludina* and *Vivipara* have the left ctenidium only and a single kidney and heart auricle. The shell is usually stout, more or less pyriform and has a well-developed operculum. The single pair of non-retractile tentacles bear the eyes upon lobes near their bases and the edge of the mantle forms a pair of short tubes by which water is directed over the gill. The sexes are always separate and the young are produced alive. Common species are *P. integra, P. intertexta* and *P. vivipara*, which live on the mud at the bottom of ponds and sluggish streams. They are, at least in part, carnivorous. Other important fresh-water families are the *Pleuroceridæ* and *Melaniidæ*, including chiefly oviparous forms which have the thick shell variously ornamented with spines and tubercles. Of the numerous forms found in the mountain streams and eastern tributaries of the Mississippi and elsewhere the large and variable *Io spinosa* is an example.

Consult: Pilsby and Tryon, 'Manual of Conchology' (Philadelphia 1878–1904); Binney and Gould, 'Terrestrial Air-breathing Mollusks of the United States' (Boston 1851 to 1859); Binney, Bland, Prime and Tryon, 'Land and Fresh-water Shells of North America' (Smithsonian Institution, Washington, 1865 to 1873); Cooke, 'Cambridge Natural History,' Vol. III. (London 1895); and for an excellent popular account Ingersoll, 'Wild Life in Orchard and Field' (New York 1903). See GASTEROPODA.

Snake, or **Lewis** (the SHOSHONE of the Indians), a river which has its rise in the mountains of western Wyoming, in two streams, called the North and South Forks. Entering Idaho the river flows southwest, then northwest to the Oregon State boundary, then north, forming the boundary for 100 miles, between Oregon and Idaho to Lewiston, and the boundary between Washington and Idaho for 30 miles. It then turns westward, crosses the southeastern part of Washington, and enters Columbia River near lat. 46° 12′ N. and lon. 119° W. Its length is estimated to be about 1,000 miles. Where the North and South Forks unite the elevation is 4,800 feet, and at the mouth where it enters the Columbia, it is 340 feet. Its course is through a mountainous country, here and there entering plains, winding around seemingly extinct volcanoes, passing through fertile lands in Washington. It is noted for its wonderful cañons, and in places for the springs that pour in great abundance from its northern wall. A fine exhibition of cataracts is furnished at the Thousand Springs near Hagerman, Idaho, between Salmon Falls and the point where the Salmon Falls River enters from the south. The springs in countless numbers issue from rocks far up the faces of nearly vertical precipices. The water does not make the descent in a single leap, but in a series of cascades. It is lashed into foam by contact with the rocks, and the beauty of the scene defies description. The Shoshone Falls (q.v.) are among the wonders of the world. Many of the cañons of the river are from 1,000 to 3,000 feet in depth and the waters flow rapidly over irregular beds forming long rapids and magnificent cascades. A number of side alcoves, or short, «blind» cañons, leading off the main cañons, owe their existence to great springs. These side cañons receive no surface streams, and there is no other explanation of their formation. The springs undermine the rock by removing the soft material on which it rests. The rock falls into the spring and gradually sinks into its soft bed, and thus the cañons are formed. Often the undermining is on so large a scale that the falling rock becomes a landslide. The water in the streams which the springs form is intensely blue and very clear. Some of them are well stocked with trout, and on the edge of a desert at that. Some day these springs will be a factor in the irrigation of this portion of Idaho.

Snake-bird. See DARTER.

Snake Dance, a dance of religious character performed by the Moqui Indians, living in Arizona, United States of America. The dance is known to have been performed by this tribe of Indians, in the same manner and in the same place, ever since the middle of the 16th century, when the Spanish explorers entered this part of America. The rite is particularly revolting in some of its details, which include the bearing of live serpents in the hands and the mouths of the dancers. As many as 100 snakes are used in a dance and each of these is borne by the dancers while dancing, either in his hands or mouth, is then deposited upon the ground, where it is sprinkled with the sacred cornmeal by the Indian squaws, is picked up, held by old men, then by little boys, infants even, and is then deposited in a sacred tent lined with buffalo skin, inside of which a sacred tree is growing. Toward the end of the dance the snakes are taken out of the tent, and carried in armfuls by the Indian men, are placed on the ground within a circle of sacred meal in front of a sacred rock. Here to the accompaniment of prayers and chants the serpents are sprinkled with the sacred cornmeal until the whole writhing, wriggling mass is completely covered by the meal. The dance concludes by the Indian men grasping each as many snakes as he can hold and dashing down a steep precipice at top speed. At its foot the snakes are liberated, scattered in every direction. The ceremony is described as most revolting. For a full account consult John G. Bourke's 'Snake-Dance of the Moquis' (1884).

Snake-doctor, a dragon-fly (q.v.).

Snake-eel, an eel of the large family *Ophichthidæ*, scaleless, and with the extremity of the tail free, that is, not surrounded by a fin. These eels are found abundantly in tropical seas about rocks and coral reefs, and are often gayly

Digitized by Google

colored like murænas, to which they are allied. Consult Jordan and Evermann, 'Fishes of North and Middle America' (Washington 1896).

Snake-gourd. See GOURD; MELON.

Snake-melon. See MELON.

Snake-stones, supposed cures for snake bites, have long been a popular superstition, brought, it is believed, from Eastern countries. The stones consist of small pieces of stone, supposed, when applied to a snake-bite, to counteract its poisonous effects, or to charm the wound away. Some of the snake-stones used in India seem to be efficacious. Two small snake-stones (about the size of a pea) brought from that country, and said to have cured a cobra bite, were found on examination to be composed of some vegetable substance. Another, which was brought from Ceylon by Sir J. E. Tennent, and which was known to have effected a like cure, was submitted to the examination of Professor Faraday, who fancied it to be a piece of charred bone which had been filled with blood perhaps several times, and then carefully charred anew. Owing to their absorbent properties such stones, if applied at once, may be of some avail. The superstition is particularly prevalent among the negroes of the Southern States, and in some portions of England and Scotland where charms made of small stones perforated and strung like beads are hung on cattle to keep away adders and to cure any snake-bites.

Snake-wood, any of various woods and plants. One is the small South American tree (*Brosimum aubletii*) which has hard, white sapwood surrounding the valuable heart, which seldom exceeds 7 inches in thickness, is reddish and marked with black in such a manner as to suggest hieroglyphics; the spots have suggested such other names as letter-wood and leopard-wood. It is used for walking-canes, veneers and cabinet-making. *Strychnos colubrina,* a climbing plant of India, like the *S. nuxvomica,* yields in its bitter roots and wood, a reputed native cure for snake-poison. *Colubrina ferruginosa* (West Indies), so called, perhaps, from its twisted grain, *Plumeria rubra.* and *Cecropia peltata,* are also called snake-wood.

Snakeroot, the popular name of numerous American plants of different species and genera, most of which are, or formerly were, reputed to be efficacious as remedies for snake-bites. For two prominent kinds see ARISTOLOCHIA and POLYGALA.

Snakes. See SERPENTS.

Snap-dragon, cultivated species of the genus *Antirrhinum* (*Scrophulariaceæ*). *A. majus* is the common snap-dragon, a pubescent perennial, native to Europe, with linear lanceolate leaves, chiefly alternate, and large showy flowers, having irregular gibbous, two-lipped corollas, the lower, three-lobed lip so swollen at the base, as to nearly close the throat of the flower, and giving an appearance so like a mouth that it has suggested many descriptive names, such as bull-dog's, rabbit's, dog's or toad's mouth; even the Greek name means "nose-like." They are handsome herbs, 1 to 3 feet high, and have flowers of many shades, and markings, and are not only cultivated in old-fashioned hardy gardens, but in greenhouses for winter floral trade. The plant is reputed, in folk-lore, to have the power of destroying charms.

Snappers, a rather numerous assemblage of fishes belonging to the genus *Lutjanus* and related genera, usually considered as belonging to the family *Sparidæ* (q.v.), but sometimes erected into a distinct family (*Lutjanidæ*). They have the body more elongated than the typical members of the *Sparidæ,* the teeth little differentiated and never incisor-like, though some are usually enlarged and caniniform and there are always teeth on the vomer. The dorsal fin is continuous, with strong spines, and the anal fin has three stout spines. The species of *Lutjanus* inhabit most warm seas and about 20 are found in our southern waters, some of them attaining importance as food fishes. The red snapper (*Lutjanus aya*) is a handsome rose-red fish, the young with a black blotch on the side. It attains a length of 2½ feet and a weight of 25 pounds, and is economically the most important of the group. Throughout the West Indian region and in the southern United States it is a great favorite, and is shipped to northern markets also in considerable numbers. The centre of the fishery is Pensacola, from which smacks visit the snapper banks in various parts of the Gulf of Mexico. The gray or mangrove snapper (*L. griseus*) is another abundant and widely distributed species throughout the same region and sometimes strays northward as far as Cape Cod. It is of a dark green color above and reddish below and is further distinguished from the red snapper by the much lower ventral fin. Being smaller than the latter it is of less commercial importance, but because of its greater abundance in shallow waters is an even greater favorite with amateur anglers. A third species is the mutton fish (*L. analis*). This is a beautiful fish in life, being olive green above, with red fins and pale blue spots and streaks on the head and sides. It equals the red snapper in size and, like the other species, frequents rocky banks and spawns in summer. It is said to be the most important food fish in Havana. All of the snappers are gamy and are caught chiefly on hand lines, but in Jamaica and other West Indian islands in cane fish-pots constructed on the principle of lobster-pots. Consult Jordan and Evermann, 'American Game and Food Fishes' (New York 1902).

Snapping Turtle, a large fresh-water turtle (*Chelydra serpentina*), widely distributed over the United States. These voracious creatures grow to a considerable size, a weight of 20 pounds being far from uncommon, and are prized as food. Their popular name is derived from their ferocity in captivity, and their habit of biting or snapping at everything that comes in their way. Called also alligator terrapin and alligator tortoise.

Snare of Love, Order of the. See ORDERS, ROYAL.

Snatch Block, a single block in use on ships which has an opening (notch) in one cheek to receive the bight of a rope. The block is iron-bound, with a swivel hook. The portion of the strap which crosses the opening or snatch in the shell is hinged, so as to be laid back when the bight of the rope is to be inserted, when warping the ship. This saves the

Digitized by Google

trouble of reeving the end of the rope through. Large blocks of this kind are called rouseabout blocks, also viol blocks.

Snayers, Peter, Dutch painter: b. Antwerp 1592; d. Brussels 1667. His teacher of painting was S. Vranx; he was elected to the Guild of Saint Luke in 1613; and went to Brussels as court painter in 1628. Of his numerous battle pieces, the majority were painted for the Austrian Court, of which works 12 are now in the Imperial gallery at Vienna. His other canvases represent cavalry skirmishes, small war scenes, hunting scenes, landscapes, painted with life-like expression and action. His works are found in most public galleries and are especially well represented in Dresden and Madrid, 16 being hung in the Prado.

Sneath, snēth, **E. Hershey,** American philosophical writer: b. Mountville, Pa., 7 Aug. 1857. He was graduated from Lebanon Valley College in 1881, and later studied at Yale. He is identified with the organization of the Modern Philosophers and the Ethical Series, books designed for the use of the student of psychology, presenting the thought of the later philosophers and the history of the psychological sciences. He has himself written: 'The Philosophy of Reid' (1892); 'The Ethics of Hobbes' (1898); and 'The Mind of Tennyson' (1900).

Snehätten, snā'hāt-tĕn («snow-cap»), Norway; the highest point of the Dovrefjeld, situated 80 miles southwest of Trondhjem. It is a snow-capped peak 7,566 feet in altitude.

Sneeze-weed, any one of the composite genus *Helenium,* as *H. autumnale,* a tall, rank-growing sunflower-like plant. It has a few long-rayed yellow heads, with protruding disks appearing in autumn, and is occasionally cultivated, although it is very coarse, with square, winged stems and alternate large punctate entire or dentate leaves. These and the flowers are bitter, acrid, and pungent, and when dried and powdered cause violent sneezing, having been used in materia medica for this purpose. Sneeze-weed is generally avoided by cattle, but animals unfamiliar with, or developing a taste for it, are often poisoned by it.

Sneeze-wood, a valuable wood, yielded by the large South African tree *Pteroxylon utile* of the order *Sapindaceæ,* and brought to market in logs sometimes 80 feet long and 4 feet in diameter. It is very difficult to work on account of its great hardness, and the dust arising causes much sneezing (whence the name), but it is handsome, with a yellowish grain resembling sandalwood, durable, and avoided by white ants and shipworms.

Sneeze-wort, a composite herb (*Achillea ptarmica*) with larger and fewer white flowers than has the common yarrow of the same genus, and finely serrate linear leaves, which, when dried and pulverized, are said to provoke sneezing. It is a European plant introduced into America.

Sneezing. See Nose and Throat.

Snelling, Fort, a small town and military post on the right bank of the Mississippi River, in Hennepin County, Minnesota. The fort was established in 1819 and is situated just above the mouth of the Minnesota River, and about six miles southwest of St. Paul. It is on the Chicago, Milwaukee and St. Paul Railroad. Fort Snelling is shown in Humphrey and Abbot's war map of the 'Basin of the Mississippi,' etc., prepared for the War Department of the United States government in 1861.

Snicker's Ferry and Berry's Ferry, Engagements at. Gen. Early withdrew from the front of Washington on the night of 12 July 1864, recrossed the Potomac at White's Ford on the morning of the 14th, rested that day and the next at Leesburg, and on the 16th marched through Snicker's Gap. On the morning of the 17th he crossed the Shenandoah at Snicker's Ferry and took position near Berryville, Breckinridge's command of two divisions covering Snicker's Ferry and the river above and below, and Rodes' and Ramseur's divisions the roads to Harper's Ferry. On the 16th Gen. Crook, commanding three small divisions of Union infantry and one of cavalry, had run into Early's rear, near Purcellville, capturing 50 prisoners and 80 wagons. Under orders of Gen. Wright, commanding the forces pursuing Early, Crook, on the 17th, sent Duffié's division of cavalry and Mulligan's brigade of infantry to Snicker's Gap, which was seized, but upon approaching the Ferry Early's well-posted artillery checked the column. On the 18th the remainder of Crook's command was pushed through the Gap and Duffié's cavalry was ordered through Ashby's Gap to attack Early's train in flank, it being the impression that Early was retreating up the valley. About 2 P.M. Crook directed Col. Thoburn, with the two brigades of his own division and one of Duval's, to cross the Shenandoah at a ford a mile or more below Snicker's and, moving up, uncover it. Here a picket of about 100 men was encountered, which opened fire, but Thoburn's leading brigade dashed across the stream and captured 15 prisoners, from whom it was learned that Early, with two divisions, was very near, and Thoburn was ordered not to advance, but to await the arrival of the Sixth corps. He had crossed his whole command and formed a defensive line; beyond his right was a force of 1,000 dismounted cavalry of various regiments, under Lieut.-Col. Young, 4th Pennsylvania Cavalry. It was less than an hour after making these dispositions that Breckinridge, with the divisions of Gordon and Echols, advanced against his left and centre, and Rodes' division fell upon his right. The dismounted cavalry broke under Rodes' fire and despite Young's effort to rally it, retreated across the river, carrying some of the infantry with it. Rodes pressed on, Thoburn changed front to meet him, but his right was forced back and driven across the stream. The left of the line repulsed two or three determined attacks and, under orders, withdrew across the river. The dead and wounded were left on the field. The Union loss was 65 killed, 301 wounded, and 56 missing. The Confederate loss was about 300. Duffié, who marched for Ashby's Gap with 2,000 men and artillery, camped near Upperville on the night of the 18th, and next morning drove some cavalry through Ashby's Gap, and with one brigade crossed the Shenandoah at Berry's Ferry, where he was met by Imboden's and McCausland's brigades of cavalry, with two guns,

Digitized by Google

and driven back. Artillery-fire was continued by both sides, and at 5 P.M. another effort was made to cross the river. One regiment charged across and up to the Confederate guns, but was quickly driven back with great loss. At night Duffié fell back to Ashby's Gap. His loss was 56 killed and wounded and 68 missing. The Confederate loss was not over 50. Wright remained at Snicker's Gap on the 19th, and that night, Early, hearing that Gen. Averell was moving from Martinsburg to Winchester, thus threatening his rear, retreated toward Strasburg. Wright advanced to Berryville on the 20th. Consult: 'Official Records,' Vol. XXXVII.; Pond, 'The Shenandoah Valley in 1864'; Early, 'The Last Year of the War for Independence.'

E. A. CARMAN.

Snider, snī'dėr, **Denton Jacques,** American author and lecturer: b. Mount Gilead, Ohio, 9 Jan. 1841. He was graduated from Oberlin in 1862, and soon after became a public speaker, giving lectures upon various subjects throughout the United States. He is the author of: 'A Walk in Hellas' (1882); 'Commentaries on Froebel's Play Songs' (1895); 'Psychology and Psychosis' (1896); 'The Life of Frederick Froebel' (1900); and numerous other works.

Snider, Jacob, American inventor: d. 25 Oct. 1866. He was the inventor of a method for converting the Enfield muzzle-loading rifles into breech-loaders. For a time he resided in Philadelphia, where he was a wine merchant, but giving up this occupation, busied himself with inventions. In 1859 he went to England and succeeded in selling his breech-loading gun to that government, but for unforeseen reasons failed to obtain his expected remuneration. He also improved devices for dyeing, brewing, coach-wheels, sheathing of ships, etc.

Snider Rifle, The. See SMALL ARMS.

Snipe, certain limicoline birds of the family *Scolopacidæ*. As explained in the article Sandpiper (q.v.) the names snipe and sandpiper are, to a large extent, used interchangeably, many of the species, more properly designated as sandpipers having also one or more local names of which snipe forms a part. Besides the woodcock (q.v.), which is closely related, four species properly known as snipes occur in North America. All of these, together with numerous species inhabiting other parts of the world, have the bill very long, much exceeding the head, grooved for its entire length, somewhat flexible, flattened and expanded at the end and there richly provided with nerves and sense-organs. Because of these peculiarities these birds are enabled to employ the bill at once as a delicate, sensitive probe for exploring the mud deeply, and as a forceps for extracting worms and similar articles of diet which they there detect. The slit of the mouth is almost totally confined to the bill; the nostrils are rather large and placed very far back, almost above the eyes and not directly in front of them as in most birds. The typical snipes belong to the genus *Gallinago*. Besides exhibiting the characters just enumerated in a high degree of development, this genus has the toes entirely without webbing, the tarsi short, less than the middle toe, the body full and plump, the wings short and rounded, the tail feathers numerous, variable in the different species and cross-barred. There is no noticeable difference in the plumage with season or sex. About 20 species are known, the majority from Eurasia and the others scattered. The only properly North American species is the well-known and favorite Wilson's snipe (*Gallinago delicata*), also known as the snipe, jack-snipe, American snipe, and, through mistaken identity, as the English snipe. Its length varies from 10 to 11½ inches, the smaller birds being females, and its color a mottled mixture of various browns, black, and white, giving a dark effect above, white below. There are 16 tail quills. Like most species of the family, it breeds northward, from the extreme northern United States to beyond the Arctic Circle. Within the United States it is widely distributed, during the spring migrating from March to May, and more abundantly in the fall from September to November. It frequents open marshes, both fresh and salt, and is consequently chiefly an inland bird, and is plentiful in the central West. In its southward journey it reaches the West Indies and South America, but seems less sensitive to cold than many of its relatives; and individuals sometimes haunt the vicinity of open springs during the prevalence of severe frosts both in the late fall and early spring. Unlike the bay birds the snipe is mostly solitary and never forms large flocks. Night is its chief season of activity, when it flies and migrates and to a great extent feeds. The soft ground in its haunts is probed in all directions for worms, insects, larvæ, and similar creatures which, with snails and slugs, are consumed in great quantities. When flushed it utters a loud, rather harsh note and flies rapidly and very irregularly for 20 or 30 yards before setting a direct course. During the mating and nesting season these birds are much about by day and are said to perform remarkable aerial evolutions, often dropping swiftly from a height with a peculiar drumming sound caused by the air rushing through the wings. The nest is a mere depression in the ground lined by a few grasses or leaves, usually in the shelter of a tussock or bush in a bog. The eggs are four and of the pyriform shape usual in the family and grayish-olive tinged with brown and blotched with browns.

The snipe is justly a favorite game-bird and presents qualities which fully test the skill of the sportsman. Its habits and haunts are so easily affected by weather and other conditions that an intimate knowledge of its peculiarities are necessary first to find and then to approach the snipe. On windy, stormy days these birds are extremely wild and their senses are so keen that an unskilled gunner will see only their jerky flight in the distance. On such occasions leave the dog at home and approach the birds from the windward side with a strong-shooting gun. As they always rise toward the wind some good shots may be afforded before the birds get well started. On warm, murky days they lie close and a well-trained setter or spaniel is necessary to flush them, especially if they be scarce. It is of course necessary to work against the wind, but when the dog marks, the gunner will do well to work to windward in order to get a quartering shot when the bird rises. The erratic flight of this bird in starting is very disconcerting to a novice and the best plan is to wait until it has steadied before shooting. As a table bird the snipe stands on a level with any.

Digitized by Google

Of the genus *Macrorhamphus*, in which the toes are slightly webbed, the legs more largely naked than in *Gallinago*, the wings longer and more pointed, and the summer and winter plumages different, we have two species, *M. griseus*, the eastern dowitcher, and *M. scolopaceus*, the western or long-billed dowitcher. The former is known in the summer plumage as the red-breasted, the latter as the red-bellied snipe, which, with the differences in the bill and the generic characters sufficiently distinguishes them. Their habits are similar and their breeding habits are essentially those of Wilson's snipe. Within the United States they frequent the sea-coasts, flying in dense but not large flocks and associating with various sandpipers and yellow-legs. Their most distinctive traits are their confiding nature, proficiency as swimmers, swift flight and compact flocking. To the first and last of these is due their destruction in great numbers by bay-bird gunners, with whom they are great favorites.

Among European species of snipes may be mentioned the common or English snipe (*G. gallinago*), scarcely distinguishable from Wilson's snipe, except that it has only 14 tail feathers, and the great or solitary snipe (*G. major*), both of which have appeared as stragglers in North America.

Consult: Baird, Brewer and Ridgway, 'Water Birds of North America,' Vol. I. (Boston 1884); Leffingwell, 'Shooting on Upland, Marsh and Stream' (New York 1887); Elliot, 'North American Shore Birds' (New York 1895); Sanford, 'Water Fowl Family' (New York 1903).

Snipe-eel, a small, excessively slender, scaleless, translucent fish of the deep seas, with jaws prolonged into a slender bill, like a snipe's, the upper mandible somewhat recurved. There are many species, which form the family *Nemichthidæ*, closely related to typical eels, but little is known of their habits.

Snipe-fish, a small fish (*Centriscus scolopax*) of the Mediterranean and neighboring waters, whose snout is prolonged into a tube suggesting a snipe's bill.

Snoring, the act of breathing with a peculiar rough noise in sleep. Such an abnormal and noisy mode of respiration is produced by deep inspirations and expirations through the nose and open mouth, the noise being caused by the vibrations of the soft palate and uvula.

Snorre Sturlason, snor're stoor'la-son, Icelandic poet and historian: b. Hvamn 1178; d. 22 Sept. 1241. Tracing his descent from the kings of Norway, he early turned his attention to the history of their doings, and made a collection of sagas entitled the Heimskringla, or the Ring of the World, in which are interspersed songs from prehistoric times and also a number of poems by the skalds of the kings, whose lives are told by Snorre. It contains a record of the Norwegian kings from the earliest time to the death of Magnus Erlingsson (1177), and was first printed in 1697. It has been translated into several languages. Snorre became chief judge of Iceland, but his ambitious and intriguing character led to his assassination.

Snout-beetle, any weevil of the family *Curculionidæ*, many of which are pests to growing plants or to stored grain, etc. One of the worst in the United States is the imbricated snout-beetle (*Epicœrus imbricatus*) which is widespread and attacks garden vegetables and fruits of all sorts, by sucking their juices.

Snow, Francis Huntington, American naturalist: b. Fitchburg, Mass., 29 June 1840. He was graduated from Williams College in 1862 and from Andover Theological Seminary in 1866, at which time he was called to the University of Kansas, then established, as professor of mathematics and natural history. In 1886 Snow Hall of Natural History was established in his honor, and in 1890 he was made chancellor of the university and professor of entomology. He was well known in the field of ornithology and metorology, but especially as the discoverer of a fungus destructive to the chinch bug. He died 20 Sept. 1908.

Snow, Lorenzo, Mormon apostle: b. Mantua, Ohio, 3 April 1814; d. Salt Lake City, Utah, 10 Oct. 1901. He studied at Oberlin College, but was converted to Mormonism through the preaching of Joseph Smith in 1836, and became a Mormon elder and missionary of the Church of the Latter Day Saints. In 1849 he was proclaimed one of the Twelve Apostles of the Mormon faith, and during the periods between the migrations of his people was identified with its attempts at public education. He was the founder of Brigham City, Utah, whose industrial system he organized on the co-operative plan. In 1898 he was elected president of the Mormon Church. He translated the Book of Mormon into Italian, and was the author of: 'The Only Way to be Saved' (1851); 'The Voice of Joseph'; and other Mormon books.

Snow is the water in solution in the atmosphere crystallized into geometrical forms, or congealed by cold into granules or irregular particles. Snow forms usually within the clouds at various heights in the atmosphere, according to the latitude, degree of cold prevailing at a given locality, altitude of clouds, etc. It is produced in great quantity in all latitudes, though it rarely reaches the earth in the tropics (except on high mountain tops), because the heat of the lower air melts it and converts it into rain. Over the circumpolar region perpetual snow covers the earth to the depth of many feet, and on the highland areas it accumulates to so great a depth that the pressure of the superincumbent mass above causes a gradual metamorphism in the character of the mass to take place, by which it is converted into glacial ice. Below 80 degrees of latitude for each hemisphere (the general limit of perpetual snow) snow occurs in general in ever decreasing quantities as the equator is approached, until at 30° it is rarely seen at sea-level. Over the northern portion of the temperate zones, and extending equatorward from 80° to about 45°, snow commonly covers the ground continuously during the winter months, and serves a most useful purpose in the economy of nature, in protecting vegetation and the earth's surface from the intense cold of winter. Owing to many causes, both meteorological and topographical, the amount of snowfall varies greatly at different localities, even as regards those situated upon the same parallels of latitude. Upon the

Digitized by Google


FORMS OF SNOW CRYSTALS.

Digitized by Google

Digitized by Google

tops of high mountains, whether these be situated within the frigid, temperate, or tropical zones, snow falls intermittently throughout each year, and above a certain height upon them, called the snow-line, remains permanently, covering the summits. Owing to local causes, and to varying meteorological and other conditions, the snow-line upon mountains varies considerably in height, even as regards mountains situated upon the same parallels of latitude. In general it approximates 1,000 feet at 70°, 5,100 at 60°, 6,800 at 50°, 10,200 at 40°, 13,500 at 30°, 15,000 at 20° and 10°, and 16,000 or 17,000 feet at the equator.

Two distinct varieties of snow occur,— the crystalline and the granular. The latter sometimes occurs as a distinct formation by itself, but more frequently as an accretion deposited by mist, or by clouds laden with minute rain-drops, upon the crystalline varieties while these are passing through them on their earthward journey. Those wholly of a crystalline character are transparent like glass, vary in size from $\frac{3}{4}$ to $\frac{1}{50}$ of an inch in greater diameter, and fall to earth singly, or bunched together into flakes, according as to whether the temperature and humidity are low or high. In general their size decreases in a certain ratio, with a decrease in the temperature of the air, and *vice versa*. The majority exhibit a tendency to divide into six, due to the fact that snow crystals belong to the hexagonal system of crystallization.

The majority of snow crystals assume forms which, by virtue of outline structure or general characteristics, may be grouped into two principal classes,— the columnar and the tabular. Those comprising the former class are all such as appear in the form of hexagonal columns, long, slender, needle-shaped crystals, or columns tapering at one end. The tabular snow-crystals develop upon an extremely thin tabular plane, whether they possess open or solid structure, or both combined. These two principal types often combine, tabular crystals forming upon one or both ends of the columnar crystals, on a plane perpendicular to their main axis, and so form compound crystals.

Crystallic growths sometimes take place from minute granular snow, the latter forming the nucleii, from which crystallic additions project or ramify in many planes. During extreme cold, or when snowfalls emanate wholly from high cirro-stratus clouds, minute sub-crystalline varieties often predominate, exhibiting an imperfect or segmentary semblance to tabular or columnar forms.

The various types of snow crystals do not occur with equal frequency, or form an equal bulk of the total snowfall. The tabular crystals, and especially those of an open, branchy structure, appear the most frequently, and the others in the following order: tabular crystals possessing solid nucleii; granular snow, minute irregular sub-crystalline varieties, solid tabular hexagons, columnar crystals, compound crystals.

The columnar crystals vary much less than do the tabular ones; such variations as occur being chiefly those relating to their dimensions, rather than their structure or aspect. The compound crystals exhibit a much greater variety of form and structure. The connecting bar varies greatly in both length and thickness in the same and in different snowfalls. The tabular crystals attached to one or both ends of the columnar bar also vary greatly at different times, both as regards size, outline and structure, and these variations often apply to the tabular crystals attached to the same bar. Commonly, whenever the connecting bar is extremely short, one of the tabular crystals attached to its ends will greatly exceed the other in size, and as a result the compound crystal (resembling a cuff-button in shape) is practically converted, for purposes of descent, into a tiny parachute, the minor tabular crystal assuming the role of parachutist; and in this order the crystals fall through the air and alight upon the earth.

The most important division into which snow-crystals are divided is the tabular class, and those grouped under this head occur the most frequently, exhibit the greatest beauty and diversity of form, and form by far the larger part of the total snowfall. The variations of outline, structure, internal ornamentation, etc., of the individual crystals of this class, both in the same and in different snowfalls, are all but infinite. No written description can adequately portray the wondrous beauty, complexity, and perfect symmetry of many of them; it far transcends that of the crystals of any other mineral species. They occur in three principal subdivisions, and the frequency of the occurrence of each is in the following order:

(1) Those of a wholly open structure (branchy); (2) those possessing nucleii of a close structure surrounded by growths of an open nature; (3) those whose structure is wholly close (solid). Owing to various unfavorable conditions, as violent winds and the collisions and fractures due to these, development proceeding while they are in motion (as in falling) or while they are in close juxtaposition, and to other unknown causes, the majority of the crystals of snow fail to attain perfect symmetry in all their parts. Commonly the nucleii outlines a minute star, a hexagon, or a circle. The number of snow-storms depositing large numbers of beautiful and symmetrical crystals at a given locality, during any one winter, does not usually exceed 16, and may not exceed 8. The great majority of the more perfect and beautiful crystals usually emanate from the clouds of the western, southwestern, or northwestern segments of great storms. In general, similar types of crystals occur in most storms, within corresponding segments of each, due to some law of general distribution. Each cloud-stratum, the high, the low, and the intermediate, and the temperatures, air-pressures, etc., corresponding with each, seem to favor the formation of a certain type of crystal; the low clouds give large branching crystals; the high clouds, small, compact ones; the intermediate clouds, medium-sized crystals, in form a composite of the low and high types.

The feature of chief interest and importance concerning the internal structure of the crystals is the occurrence therein of minute inclusions of air and air-tubes. These appear by transmitted light as dark lines or shadings, etc., because of the absorption, interference, or refraction of the rays of light that strike or pass through them. The beautiful and usually symmetrical

Digitized by Google

arrangement of these air-tubes and compartments impart to this type of crystal its principal charm. These air-inclusions are of great interest, because of the great number of distinct and varied inclusions that often appear within the same and within different individual crystals, and also because it may be assumed that they were not formed in regular progressive order, but in intermittent order from the nucleii outward, while each new and distinct outgrowth was being added to and arranged upon and around the growing crystals; and hence they outline the boundaries of each of the many preexisting shapes the crystals successively assumed in cloudland.

Hundreds of drawings of this variety of snow crystal have been made by various observers, among them Dr. Scoresby and James Glaisher of England, Professor S. Squinahal of Italy, and Mrs. F. E. Chickering of Portland, Maine. Many of these have been published in text-books and other publications. More recently the aid of photography has been invoked in securing and perpetuating the 'likenesses of these beautiful but fleeting forms. During the winter of 1902–3 Dr. Neuhauss of Berlin secured microphotographs of them, and about the same time Herr Sigson of Russia and Dr. Nordenskiöld of Stockholm also secured microphotographs. Many of these were published in the 'Meteorologische Zeitschrift' for 1894, in a paper issued by the Geological Society of Stockholm, and also in a book by Dr. G. Hellman, entitled 'Schneekrystalle.' The pioneer in this work, however, seems to have been W. A. Bentley of Jericho, Vt., who began the photographing of them during the winter of 1885. By the spring of 1904 the microphotographs secured by him numbered over 1,100, no two alike. Many of these were published in a publication issued by the United States Weather Bureau, entitled 'Studies Among the Snow Crystals, Winter of 1902.' These photographic studies, in connection with the meteorological ones made simultaneously, have greatly increased our knowledge of these most interesting crystal forms.

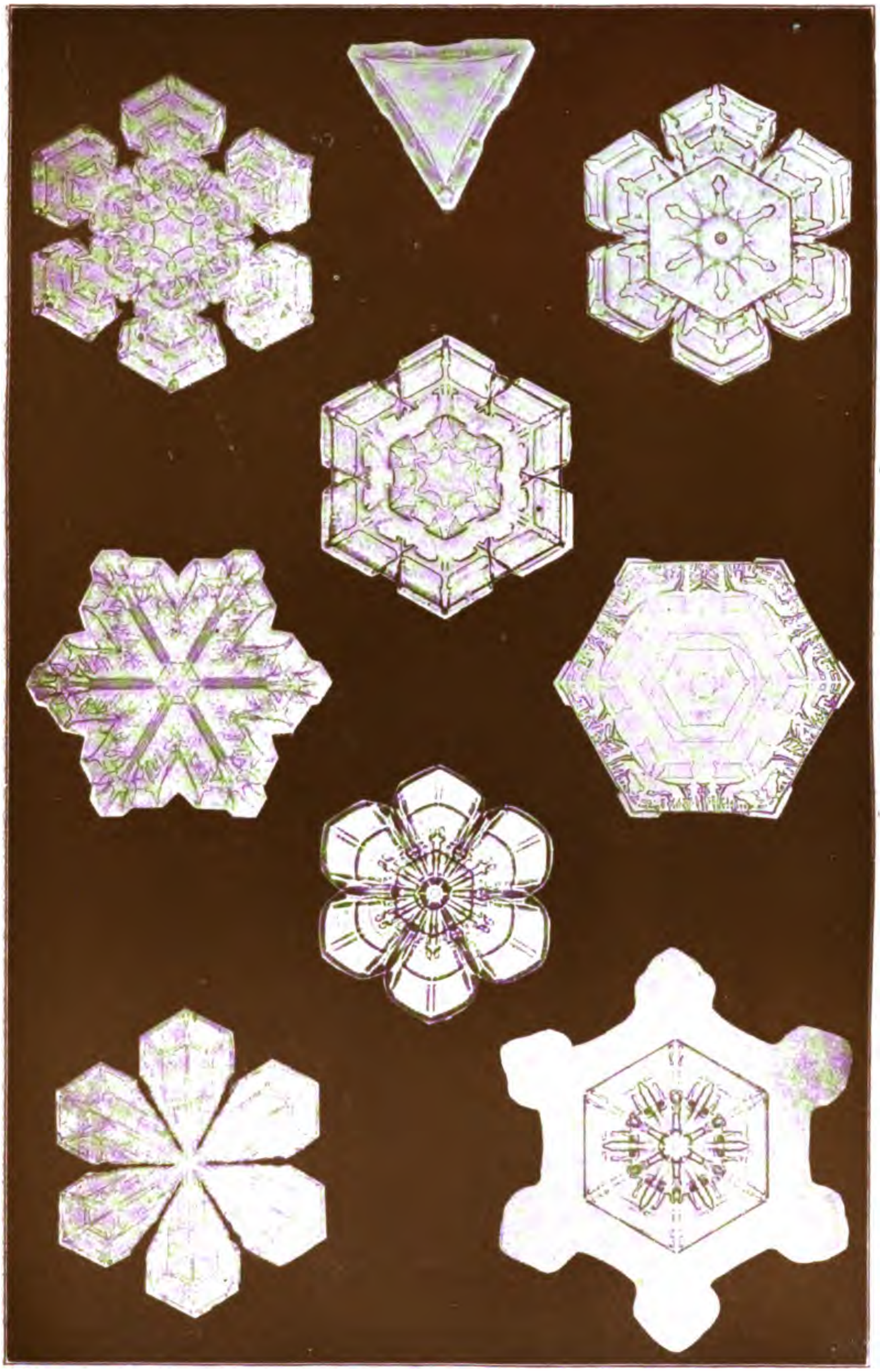
The manner in which the snow crystals form is this: They crystallize in a liquid (the air) of small density, which is often in a state of agitation where the crystals are forming, and whose degree of density, humidity, etc., is ever changing; and usually among a multitude of uncongealed or uncrystallized particles of vapor, called cloud. The commonly accepted theory is that these visible cloud-particles unite to form the true snow-crystals. This is doubtless true, in so far as the granular varieties are concerned, but the true crystalline varieties probably form direct from the invisible water-molecules floating in the air, before these unite to form the vastly larger cloud-particles. It is possible that the cloud-particles are essentially the dross, residue, or excess of moisture left over during the process of crystal-building. A portion, at least, of this residue or excess of moisture ascends, and is congealed in the upper air, into the semblance of minute snow-crystals; appearing in the form of the cirrus cloud above, and often around all storms of great duration or magnitude. Many occurrences are on record of snowfalls occurring from skies clear or nearly free from visible clouds, and this lends additional weight to this theory. So very light are many of the snow-crystals, especially while they are in a nuclear or uncompleted state, and so strong are the expanding, uprushing air-currents within many portions of great storms, that it must be assumed that many crystals are wafted upward, perhaps repeatedly, and acquire growths at greater altitudes than that wherein the nucleii originated, before they attain sufficient weight to fall to earth. Doubtless the multitudinous changes of form and structure that many of the crystals undergo within the clouds during growth, are due to these many vertical and horizontal flights within the clouds, and to the great and ever-changing variety of meteorological and other conditions prevailing therein, each of which impresses its especial condition upon them.

The production and deposition of the snow, occurring, as it does, over so large a portion of the earth's surface, are phenomena of great magnitude and importance. Snow not only changes the whole aspect of nature, but it also serves many useful purposes. It conserves the heat of the earth and protects vegetation from the intense cold of winter, and even in northern regions, where deep snows occur, it is not considered a serious impediment to travel or commerce. A track once made, the compacted snow affords an excellent roadbed, over which heavy loads of merchandise can be easily and quickly transported on sleighs. But while in the abstract its manifestations are beneficent, in the concrete, some of them are otherwise. Much damage often results from the great inundations caused by the sudden melting of deep snow over large areas; and its sudden accumulation to great depths often causes a temporary blockade of railroad service, and travel in general. A large fall of damp snow or sleet sometimes accumulates so heavily upon telegraph and telephone poles and wires, and upon the limbs and smaller trees of the forests, that they break under the great weight. Snow-slides from the steep sides of mountains sometimes occur, and bury and destroy whole villages. Altogether the snow fills a most important place in nature's plan. Not only is it beautiful in itself, composed of the most graceful crystal forms that occur in nature, but it plays an important part in beautifying earth and sky, forest, and mountain. W. A. Bentley,

Author of 'Snow and Snow Crystals.'

Snow-ball, or Guelder Rose, any one of the varieties of several species of *Viburnum* (*Caprifoliaceæ*) in which the flowers are all sterile and showy. The cranberry bush (*Viburnum opulus*) is the original snow-ball, common to Europe and America, and a handsome shrub, often 12 feet in height, with grayish bark, and alternate three-lobed leaves. The flowers are normally arranged in peduncled cymes, the central florets being small, 5-merous, and fertile, surrounded by a few neutral flowers, with flat, white corollas expanded to an inch in breadth. The cultivated form of this is a sport, where all the flowers are sterile and expanded into snowy spherical masses. Certain similar Japanese and Chinese sports of *V. tomentosum* and *V. macrocephalum* have been introduced into America, the latter having flower-heads nearly as large as those of hydrangeas, and both being hardy, tall, strong-growing shrubs with handsome foliage. They are supplanting the old-fashioned *V. opulus* which suffers from *aphis*.

Digitized by Google



FORMS OF SNOW CRYSTALS

Digitized by Google

Snow-berry, a name applied to several white-fruited plants, among them the rubiaceous *Chiococca racemosa* of tropical America, a climbing plant with yellow flowers and white berries. It has medicinal properties, and the root, known as calunca-root, was used as a diuretic. The cultivated snow-berry (*Symphoricarpus racemosus*) is a small, smooth, much branched shrub of the honeysuckle family, common in northern North America. It has opposite oval leaves, and inconspicuous rose-colored flowers in racemes, often leafy. While of somewhat sprawling habit, snow-berries are valuable because of their power of increasing rapidly by suckers, and for their ornamental white, pulpy berries, borne in such abundance as to bend down the slender branches, and retained far into the winter. The creeping snow-berry is another northern plant (*Chiogenes hispidula*), an evergreen trailing shrub, found in sphagnum bogs and mountainous evergreen woods. It is pubescent, with alternate two-ranked ovate leaves, and axillary, small, white flowers, succeeded by somewhat dry white berries. The whole plant has the aromatic taste of sweet birch.

Snow-bunting, or **Snow-flake,** a large bunting (*Plectrophenax nivalis*), common in the northern regions of both hemispheres, and visiting the United States and central Europe in flocks during the winter. They haunt the open, treeless wilds, and place their nests on the ground or in the crevice of a rock throughout northern regions. Their long hind claws serve to distinguish them from the true buntings, giving them a certain similarity to the larks, which they also resemble in running swiftly and in never perching (compare LONGSPURS). In winter the plumage of the male is almost or quite pure white. The summer dress exhibits a tawny brown hue, spotted with white, the back darker. The average length is about seven inches. The song is sweet, but faint. The Laplanders account the flesh of these birds a great delicacy; and in Greenland they are caught and dried in great numbers. The food consists of seeds of various kinds.

Snow-drop, any one of the 50 or more cultivated varieties of the genus *Galanthus* (*Amaryllidaceæ*), the most common being the European snow-drop (*G. nivalis*), famous for its midwinter blooming. They are small, low plants, with bulbous roots, narrow leaves, and nodding white flowers, touched with green. The corollas are somewhat bell-shaped, having six segments, the three outer concave and spreading, and the others straight and shorter. *Galanthus elwesii* is one of the largest flowered varieties. Although usually very early spring bloomers, giving the bees their first supplies of honey, some varieties appear in the autumn, and were, for a while, rare plants.

Snow-flake, any one of the species of *Leucojum*, a genus of the *Amaryllidaceæ*, resembling the snow-drops, but larger, and having the six segments of the perianth equal. They are graceful, nodding flowers, pure white, except where touched with green at the tips of the petals, and are low and bulbous, with narrow leaves. *L. venum* blooms soon after the snow-drops and crocuses, while *L. æstivum*, the summer snow-flake, a species of continental Europe, blooms still later, and has several flowers on a stalk.

Snow-goose, an Arctic goose (*Chen hyberboreus*). See GEESE.

Snow Leopard, or **Ounce,** a large cat (*Felis uncia*) of the high mountains and plateaus of central Asia, where it is often found in snowy forests near the limit of timber growth, and rarely descends below 9,000 feet. It feeds on wild and domestic sheep, goats, and dogs, but is not feared by the men of the region. Mivart points out its special interest as a large feline animal adapted to live in a cold climate, and says: "It is clothed in a dense long fur, which even forms a short mane. It is 4 to 4½ feet long, without the tail, which measures a yard. The fur is of a pale yellowish gray, with small irregular dark spots on the head, cheeks, back of neck, and limbs, and with dark rings on the back and sides. It is whitish beneath, with some large dark spots about the middle of the abdomen. The long bushy tail is surrounded by incomplete black bands." Its fur is one of the most handsome and valuable yielded by the cat tribe.

Snow-line. See SNOW.

Snow-owl, a large owl (*Nyctea nyctea*), a native of the north of Europe, Asia, and America. In old birds the plumage is occasionally pure white, but in younger and most adult birds each feather is tipped with dark brown or black. The length of the adult male is about 20 inches, that of the female four or five inches more. This is one of the largest of the owls, and is at once distinguishable from the great horned owl, the only other species of equal size which occurs commonly in the United States, by the absence of ear-tufts. It breeds altogether north of the United States, and while it is quite capable of enduring the cold of Arctic winters, a larger or smaller number migrate southward, but most irregularly, every winter. During some winters it is very rare, and sometimes very common in the Middle States, and it may straggle quite to the Gulf coast. The 5 to 8 large white elliptical eggs are laid in a nest built on the ground in a rocky spot. This is one of the most diurnal of the owls and frequently hunts by day, its prey being hares, grouse, ptarmigan, and similar mammals and birds, as well as rats and mice. See OWL.

Snow Plow, a machine or implement used to clear snow from roads, tracks, and pathways. The simplest form for common highways consists of boards framed together so as to form a sharp angle, like the letter A in front, and spreading out behind to a greater or less width. Being drawn along with the apex in front, the snow is thrown off by the boards to the side of the road or path, and thus a free passage is opened for traffic. The snow plow in common use on urban street railways consists, roughly, of a heavy car on high trucks; underneath the floor of the car and before or behind each pair of wheels are huge rotary brushes, of cane, wood-fibre, or some stiff material. These brushes are set obliquely across the track, at right angles to each other, and are about two feet or a yard in diameter. When the car is in motion power is supplied (from the same source as the motive power), and the brushes rotating

Digitized by Google

swiftly sweep the track clear of the snow, which is thrown to either side. This is further removed by means of side drags, or boards obliquely attached to the car and set edge up, on either side, the point of the angle which they make with the body of the car being directed to the front. Snow plows are in common use on the Western and Northern railroads in the United States and Canada. They are of many different patterns, the machinery for such purpose being improved and revised every year. They are constructed more or less on the same principle, which comprises pairs of rotary blades obliquely set in a drum casing open at the front end, and driven by horizontal shafts, the other ends of which are connected with machinery in the body of the car, from which the driving power is supplied. Such an engine is coupled to the locomotive, from which it draws the steam necessary for the operation of the plow through connecting pipes. Another locomotive is hitched behind to supply the moving power, then comes the train of cars, and, in many cases, behind these another locomotive to help in the pushing. By means of such contrivances the railroads have been enabled to operate through severe snowstorms, cutting through drifts which completely bury their tracks and which before the invention of the snow plow necessitated complete suspension of traffic. Snow plows have recently been introduced into Russia.

Snowbird, a North American finch of the genus *Junco,* in which the plumage is not streaked, and the two marginal feathers of the tail are white. They are northern birds, the eastern ones breeding south of the Great Lakes only on the tops of mountains, and the several western species inhabiting Canada or the peaks of the Rocky and Pacific Coast Mountains, making their nests on the ground. They appear in the middle districts about the time of the first snowfall, and remain as familiar winter residents. The common *Junco hyemalis* of the United States east of the Missouri, is 6¼ inches long; grayish or dark ashy black all over the head, neck, and upper parts, with the breast, belly, and under tail coverts, and the first and second external tail feathers white. Western species, such as the Oregon snowbird, exhibit a greater or less amount of chestnut tints in the plumage. They utter sharp chirping notes in winter, but sing prettily during the breeding season.

Snowdon, snō'dŏn, Wales, a mountain-range in the northern county of Carnarvonshire, extending from the neighborhood of Cardigan Bay to that of Conway. It is crowned by five summits, of which Moel-y-Wyddfa is the highest (3,560 feet). The range is steep on the west, but more gradual on the east. It is penetrated by many valleys and streams, the most important of which are the Cwmglas and Cwm-y-Llan. There are some beautiful lakes, which attract many visitors. Bettws-y-Cold is one of the centres of resort. An electric railway to the summit of Snowdon was completed in 1895.

Snowshoe, a kind of supplementary shoe used by the Northern Indians, the Canadians, Laplanders, and other residents of countries where snow remains for long periods. It consists of a frame of bent wood, usually maple, interlaced with a network of deer's hide (or, sometimes, with deer's sinews), or moose or beaver skin cut into strips. The portion where the ball of the foot would rest is more closely woven than the rest, and is further strengthened by a piece of light, tough wood strapped across from side to side. The shape of the snowshoe is elliptical, being rounded in the front and drawn out to a long blunt neck at the back. Its size is usually about three feet in length and a foot to a foot and a half in width. This large, flat surface furnishes a larger plane of resistance to the soft snow and will not sink into it, and by distributing the weight of the wearer over a larger surface than the foot does, does not break the brittle crust on the top of snow, which makes progress without snowshoes impossible. In use, the wearer encases his feet in moccasins and further protects them by wrappings or many pairs of stockings. This is necessary to prevent the foot from being chafed by the strap, into which the toe is passed. This strap is in the middle of the snowshoe, over the strap of wood, near the front; the heel of the foot is not attached to the snowshoe at all. When the heel is raised in walking, the snowshoe is not lifted, but remains flat on the ground, then, as the foot is lifted the toe elevates the forward part of the snowshoes, and it is dragged along on the snow as the leg advances. Experts can walk on snowshoes with great rapidity, but there is a swinging outward motion that must be acquired before the novice can hope to make the shoes serviceable. When there is a light crust on the snow snowshoes allow the hunter to overtake deer, moose, and other hoofed animals, whose pointed feet piercing the crust sink through the snow and make rapid flight impossible. In Canada races on snowshoes have become a regular feature of the winter sports, and records show 100 yards covered in 10 seconds; one mile in from four and a quarter to five minutes; five miles in from 31 to 33 minutes. Snowshoes are frequently highly ornamented and among some of the Indians serve as love tokens. See Ski. Consult, for records, the reports of 'The Montreal Snowshoe Club.'

Snuff, a powder manufactured from tobacco and used for chewing and for inhaling through the nose. For the manufacture of the finest grades of snuff only the choicest portions of fine leaf are used, but for the ordinary commercial brands the thick, stemmy portions, the mid-rib, and scrap tobacco are employed. The making of snuff is one of the most intricate processes for which the tobacco leaf is used. The peculiar aroma and fragrance in snuff are obtained by a species of fermentation induced in the leaf by packing it, moist, in large quantities and subjecting the mass to a high temperature. Snuff is either moist or dry, the details in manufacture differing only in regard to the amount of moistening undergone. The moist snuffs are known as rappees, and the dry under various names, the varieties known as Irish, Scotch, and sweet snuff being common. The manufacture of French rappee has been brought to a high degree of excellence by the French government which owns large factories. The tobacco is subjected to two processes of fermentation, whereby aroma and strength are

Digitized by Google

acquired, and the nicotine and organic acids removed. The leaves and stalks, moistened with salt water (to prevent putrefaction), are pressed into cakes and sliced, and left in open chambers for five or six months to ferment and develop aroma, the temperature at times reaching 140° F. After that time the tobacco is ground in mills out of contact with air, in order to preserve the aroma, and the powder, rapé sec, is after damping conducted to closed wooden chambers to undergo during 10 months the second fermentation, which imparts strength to the snuff. During this fermentation the temperature is kept at from 120° to 130° F. and the snuff is frequently repacked, to ensure uniformity. Finally the snuff is gathered from the fermenting rooms into one large chamber, where it matures for one month; it is then ready for stamping into casks. The machinery used in the French factory is almost wholly automatic. Snuff is very commonly adulterated in order to increase its bulk or pungency. During its manufacture various flavoring sauces and waters are used for dampening both the leaves and the rapé sec, and in this way the flavor of the finished snuff is effected. The processes of manufacture occupy about 18 to 20 months, and in this time, by the repeated fermentations, about two thirds of the nicotine is destroyed, the acids (malic and citric) are destroyed and the acetic acids and bases evolved leave free ammonia in the snuff. This, with the slight free nicotine and the aromatic pungents, are desired qualities. The Scotch and other dry snuffs are commonly slightly adulterated with quicklime, which gives the biting, desiccating effect for which they are peculiar. Snuffs are scented with musk, essences of bergamot, lavender, attar of roses, cloves, orange flowers, jasmines, etc.

The practice of snuff-taking was introduced into Europe from America during the 16th century, and during this and the following century became very general throughout the continent and in England. Its use in England greatly increased under the reign of William and Anne, and in France under the various Louis. The practice, although almost entirely abandoned by the upper classes to-day, is more widely prevalent than is commonly thought. The consumption of the drug in the British Isles is said to amount to more than 900 tons annually. In the United States, where the consumption is about 9,500 tons a year, the chief users are foreign-born. The snuff used in this country is all of domestic manufacture, the small amount of French snuff imported not being worth considering.

Snuff-boxes, for retaining small quantities of the powder about the person are of great variety of shape and material. When snuff-taking was one of the habits of society these boxes were often of much value and beauty of workmanship. Gold, silver, and precious stones were employed in their manufacture and some of the boxes of crowned heads and of the popes are famous for their workmanship. The ordinary boxes used by the snuff-takers to-day are of horn, papier-maché, or lacquered wood, and are made largely in France and Germany.

The habit of taking snuff is said to be one of the pleasantest of the many ways of using tobacco. The snuff, pinched up between the thumb and forefinger is drawn into the nostrils by sharp, deep inhalations. In a few moments it produces a ticklish sensation, which frequently causes sneezing, and is highly gratifying to the user. The habit of "dipping snuff," at one time common among the poorer classes in the South Atlantic portions of the United States, consisted in holding in the mouth the well-chewed end of a dry twig, which had been dipped into powdered snuff. The habit is still prevalent in some sections.

Snyder, snī'dėr, **Simon**, American military officer: b. Selin's Grove, Pa., 9 Feb. 1839. He was graduated from the United States Military Academy in 1861, and served in Sheridan's campaign during the Civil War. He was assigned to frontier duty after the war, and was brevetted major for gallantry in the field in 1890. At the outbreak of the Spanish War he was made brigadier-general of volunteers and placed in command of the first division of the First Army corps in Cuba. In 1898 he was made military governor of the Cuban province of Santa Clara. The following year he was mustered out of the volunteer service and assigned to duty in the Philippines. In 1900 he was transferred to home duty and served as inspector-general of the Department of the Lakes. In 1902, having attained the rank of brigadier-general in the United States army, he was retired.

Snyders, snī'dĕrs, **Franz**, Flemish painter: b. Antwerp 1579; d. there 19 Aug. 1657. He studied under Brueghel, the younger, and Hendrick van Balen. In 1602 he was elected master of the Guild of Saint Luke. In his early life he painted fruit and flowers. Rubens engaged him to paint still-life accessories in his pictures, and in turn Rubens often painted the figures for Snyder's canvases. His pictures are found in all the great galleries of Europe. His masterpiece, 'Two Lions Pursuing a Roebuck,' is on exhibition at Munich.

Soane, sōn, Sir **John**, English architect: b. Whitchurch, near Reading, 10 Sept. 1753; d. London 20 Jan. 1837. He was a mason's son, and was for a time an errand boy, but having gained some architectural knowledge, won first the silver medal (1772) and afterward the gold medal (1776) of the Royal Academy, the latter for a design of a triumphal arch. In 1788 he was appointed architect to the Bank of England, and in 1791 clerk of works to Saint James' Palace, the Parliament Houses, and other public buildings. He was elected A.R.A. in 1795 and R.A. in 1802, and became professor of architecture to the Royal Academy in 1806. He was knighted in 1831, and at his death bequeathed his collection of works of art and $130,000 to the nation. The Soane Museum thus formed is housed at 13 Lincoln's Inn Fields, London, and contains antique sculptures, bronzes, gems, models of ancient buildings, a collection of pictures, etc. Consult 'Memoir' by Britton (1834). He published plans of 'Public and Private Buildings' (1828).

Soane Museum, The. See Soane, Sir John.

Soap. The cleansing properties of the substance produced by heating together natural fats and caustic alkalies have been known for a very long time; the manufacture of soap upon a large scale dates only from about 1823, in

Digitized by Google

which year Chevreul published his famous researches upon the animal fats. The natural fats — palmitin, stearin, olein, etc. — are acid ethers of glycerin. Glycerin is an alcohol containing three atoms of replaceable hydrogen, its formula is $\left.\begin{matrix}C_3H_5\\H_3\end{matrix}\right\}O_3$; in the fats these three hydrogen atoms are replaced by the radicles of various acids, chiefly of palmitic, stearic, margaric, and oleic acid, and thus are obtained the fats palmitin, represented by the formula

$$\left.\begin{matrix}C_3H_5\\(C_{16}H_{31}O)_3\end{matrix}\right\}O_3;\ \text{stearin,}\ \left.\begin{matrix}C_3H_5\\(C_{18}H_{35}O)_3\end{matrix}\right\}O_3;$$

$$\text{margarin,}\ \left.\begin{matrix}C_3H_5\\(C_{17}H_{33}O)_3\end{matrix}\right\}O_3;\ \text{and olein,}$$

$\left.\begin{matrix}C_3H_5\\(C_{18}H_{33}O)_3\end{matrix}\right\}O_3$. If these fats be heated with caustic alkalies they are decomposed, a union taking place between the particular acid, the radicle of which exists in the fat, and the alkali metal, while glycerin is at the same time produced; thus with the stearin and caustic potash the reaction may be formulated:

$$\left.\begin{matrix}C_3H_5\\(C_{18}H_{35}O)_3\end{matrix}\right\}O_3 + 3KHO = \underset{\text{Glycerin.}}{\left.\begin{matrix}C_3H_5\\H_3\end{matrix}\right\}O_3} + 3\ \underset{\text{Potassium Stearate.}}{\left.\begin{matrix}C_{18}H_{35}O\\K\end{matrix}\right\}O.}$$

The salt of the fatty acid so produced (in this instance potassium stearate) is called a soap. Soaps therefore may generally be defined as the metallic salts of the higher fatty acids, and the process whereby these salts are produced from the natural fats is called saponification. Although this includes under the name soap all the metallic salts of the higher fatty acids, yet in ordinary language the name is limited to the sodium and potassium salts of these acids.

Soaps are sometimes produced by treating oils with caustic alkalies; these oils often contain the higher fatty acids in the free state; they are more easily saponified than the fats.

The essential parts of a soap then are (1) the alkaline metal and (2) the fatty acid which it contains; upon these two the quality of the soap depends. The processes by which soaps are produced may be divided into two classes — (1) saponification of fats (that is, of acid ethers of glycerin), and (2) saponification of oily bodies containing free fatty acids.

Materials and Manufacture.—There are various sources for the fats used in the production of soap. The berries of the soap-tree of South America and the West Indies possess excellent natural qualities for the manufacture of soap, and the bark of the *Quillaia saponaria* from Peru is used in Liverpool for washing woolens. In California the roots of the *Phalangium pomaridianum* are found in great abundance, and having the odor of brown soap; these are used for washing clothes. Different kinds of oils are used in the manufacture of soap, these offering different proportions of approximate principles of fatty bodies, such as stearin, palmitin, and olein. Different kinds of alkalies used to unite with the fats produce soaps of varying hardness, soda making a harder soap than potash. The hardest soap is made by the use of stearin and soda, and the softest soap by the union of olein and potash. Glycerin is often combined with fatty acids, since it is broken up by the action of the alkali, the glycerin then existing in a free state in the soap, or it may be extracted as a separate product. The principal fats and oils used in the manufacture of soap are tallow, and palm, rape, poppy, linseed, hemp-seed, and olive-oils.

Olive-oil is used in the manufacture of Castile, Marseilles, and other marbled and plain soaps of southern Europe. Similar results by similar methods are attained in this country. The best oils for marbled soaps are obtained from Naples. The Spanish oils are also valuable for the same purpose. The oils from the East are not so rich in stearin, and contain a certain amount of green pigment, which make them less desirable. Mottled or marbled soaps are obtained by sprinkling the surface of the freshly made substance successively with lyes less and less concentrated. The saponification is conducted ordinarily by boiling the fat with a solution of caustic potash or soda. Most fats require a long boiling with an excess of alkali, but lard, beef-marrow, and the oil of sweet almonds may be saponified merely by an agitation with caustic soda at an ordinary temperature.

The secret of the cleansing power of soap has never been satisfactorily explained; yet while it is generally supposed to be due to what is known as hydrolysis, or partial decomposition into free alkali and insoluble acid soap, it is probably due, as a matter of fact, to the power of the solution to emulsionize fats.

The processes of soap manufacture are three in number, according to the ordinary classification. First. there is a process of direct union of free fatty or resinous acid and alkalies, a process which is not much in use. Second, there is the treatment of fats with definite quantities of alkalies, in which the glycerin remains with the soap. This is known as the cold process. Third, there is the treatment of fats by boiling them with indefinite quantities of alkali and lye. The great bulk of soaps is hard soap, and this is of three kinds — the curd, the mottled, and the yellow. The finest quality of the curd soap is obtained by the use of tallow, the lye being concentrated by the use of close steam till the soap is hard. In producing mottled soap, while the process is the same as in the manufacture of the curd, darker fats are used, and concentration of the fats is not carried to such an extent as with the other. When there is a natural mottling of the soap it is an absolute guaranty that there is no undue amount of water present in it. The artificial mottling of soap is carried on to a very large extent for legitimate purposes; but there are those who practise it for the express purpose of fraud. The mottling process is largely used for laundry-soaps. Yellow soaps contain more or less resin, the finest qualities of such soap being secured by the use of light-colored resin and the best grade of tallow. The finishing or fitting of yellow soaps requires long experience on the part of the manufacturer for satisfactory results. The method of finishing all kinds of soap is a variable factor, depending upon the precise kind of article desired.

In the production of cocoanut or marine soaps the cocoanut-oil is saponified by the use of strong lye without salting. After several days of hardening the blocks of soap are first cut into slabs by means of a thin steel wire, and the slabs are then transformed into bars. These bars are stamped with the name of the maker and the brand of the soap, and are then ready for the market.

Digitized by Google

The demand for cheap soap has resulted in the introduction and extension of a process known as filling. In this various substances designed to increase the detergent power of the soap, or to increase its bulk and weight, thus lessening its power, are introduced into the soap after it leaves the copper. This process is also known as crutching. The substances used as adulterants are water, talc, clay, chalk, sulphate of baryta, etc. In the production of soft soaps impure solutions of potash soaps are combined with glycerine in caustic lye, which results in transparent jellies.

In the production of toilet-soaps special precautions are taken against the presence of free alkali. The soap is cut into shavings. It is then partially dried, and, coloring-matter and perfumes being added, the composition is passed several times between granite rollers to make it homogeneous. The mass is then clotted by the use of great pressure which forms the soap into bars. These bars are then cut and stamped. The lowest qualities of toilet-soaps are generally made by the cold process. Many kinds of transparent soaps are made by the cold process, the transparency being accomplished by the addition of sugar. Glycerin is often incorporated with opaque and transparent soaps for emollient effects, while for disinfecting purposes carbolic acid, coal tar, eucalyptus-oil, and other substances are added. The commercial value of all soaps depends upon the percentage of fatty anhydrid present in them.

Specific Properties.— Silicated soaps are produced by mixing silicate of sodium (soluble glass) with ordinary soap. These soaps are cheaply produced, and have very considerable detergent power.

Toilet-soaps are produced by perfuming the best ordinary curd-soap with essential oils, or sometimes by saponifying lard, beef-marrow, or oil of sweet almonds with caustic soda-lye, in the cold, and perfuming the products.

Light or flotant soap is produced by agitating a solution of soap, to which a fifth or sixth part of water has been added, until the lather has risen to a considerable height, and then transferring it to a mold, where it remains until the quality of transparency is fixed.

Transparent soap is prepared by drying ordinary soap, dissolving it in alcohol, allowing the solution to remain at rest so long as any impurities are precipitated, decanting off the alcoholic liquid, and evaporating it until it is of such a consistency as to solidify when cooled in metallic molds.

Mottled soaps are produced by mixing mineral coloring-matter with the soap during a certain stage of the hardening.

The amount of fatty acids in soap varies from 60 to 70 per cent; of water, from 20 to 30 per cent; and the proportion of alkaline bases, from 8 to 9 per cent. These numbers may be taken as a standard from which pure soaps should not very greatly differ.

Soaps are scented and colored by mixing coloring-substances and volatile oils or odorous matter with them. Sometimes, for the purpose of producing a medicated soap, antiseptics, such as carbolic acid, creosote, chloride of potash, and sulphur, are mixed with the ingredients. A soap for the use of taxidermists in preserving skins is produced by the addition of arsenic. A large industry has developed in this country in scouring-soaps, which are produced by the addition of fine sand or pumice-stone to the ordinary soap when in its plastic state.

History of Soap-making in America.— In the American colonies soap-making was at first largely a household art, the housewife utilizing the fats saved from the dripping-pan to make soft soap for her own use, and also even a sort of hard soap, of a quality, however, that would not suit the housekeeper of to-day.

As early as 1608, on the second ship from England to the Jamestown colony, came a number of Germans and Poles, skilled craftsmen, among whom were several proficient in handling fat and soap-ashes. In 1621 soap-ashes for export to England were worth from six to eight shillings per hundredweight, and 50 years later the settlements now included in Maine and New Hampshire derived their chief wealth from soap-ashes and fat. While there were small soap-boiling establishments in nearly all the large towns by 1795, their aggregate product probably did not exceed $300,000 in value. The discovery by Nicolas Leblanc (q.v.), about 1791, of a process for manufacturing soda on a large scale was utilized some 30 years later, when chemical manufacturers and soap-makers began to avail themselves extensively of the supply of soda thus cheaply afforded.

Among the early establishments of the soap trade one of the largest was that of William Colgate in New York, founded in 1806. Fancy soaps were at this time unknown, and the makers of the American product contented themselves with a very common grade of soap; but so rapid was the advance that by 1835 they were supplying nearly all the home demand, and were also heavy exporters, principally to England.

About 1850, American manufacturers were employing substantially the same methods and processes that were used in England. New England was then the principal centre of the manufacture for the United States, although New York and Philadelphia were gaining prominence. At that time filling materials were practically unknown, and "settled" soaps were merely run into the wooden frames and crutched for hours, until rendered thick from cooling, or were finished by boiling down. The material was ladled by hand from the kettles into the frames, or put into buckets or tubs and carried and emptied into the frames. The kettles themselves had cast-iron bottoms, to which a wooden curb was fastened by means of cement. The composition of this cement, which was used to prevent leakage, was regarded at that time as a great trade secret, especially when the cement was capable of preventing the leakage for some length of time. The waste lye was run off through a pipe reaching through the wooden curb to a point near the bottom of the kettle. The kettles were heated by open fire, and the contents were kept from burning by stirring them with a long iron rod flattened at the end. The lye was made by leaching wood-ashes, since the use of caustic soda had made very slow advances.

While processes and methods were thus, comparatively speaking, at a standstill during the first four decades of the 19th century, the soap industry nevertheless steadily advanced in importance, and prepared itself for the wonderful

Digitized by Google

development that immediately followed the discoveries of Chevreul. That chemist demonstrated the true principles of saponification, and no later improvement, whether in the introduction of the steam processes or in the discoveries and uses of the many new vegetable and animal oils, has been of greater importance. Of the total soap product at this time Massachusetts was credited with over one quarter. Five years later the soap industry had grown to great proportions. The manufacture of fancy soaps had already been begun, and in 1850 was established on an extensive scale. Shaving-soap, always in great demand in those days, when beardless faces were the rule, was also greatly improved in this decade, and many other of the common toilet necessities of to-day were either first brought out or developed to comparative excellence at this time. Soon soap-making was facilitated by the introduction of machinery, and now there are specially constructed machines designed and adapted for almost every step in the different processes of manufacture where their introduction has been either feasible or of advantage. At present American soaps are strong competitors in the markets of the world, and in quality they rival the best of European production; while in annual output the value has risen from about $18,000,000 in 1860 to more than $60,000,000 in 1910.

The introduction of sapolio marked a new era in the soap business. It was a combination of true soap and scouring substances in such proportions as to increase to the highest point the advantages of each. The Bath brick of the scullery has gone since its advent, and the principle upon which sapolio was established is now utilized in many forms. Great as has been the recent advance in the soap industry of the United States, it is confidently predicted that still greater progress will yet be made. A wider knowledge of applied chemistry, the development of all subsidiary interests, an ever increasing capital, and a constantly growing market, both at home and abroad, would seem to give assurance that the prediction will be abundantly fulfilled. Consult: Thorpe, 'Dictionary of Applied Chemistry'; Richardson and Watts, 'Chemical Technology'; Cristani, 'Soap and Candles'; Wurtz, 'Dictionnaire de Chimie.' See FATS; SAPINDACEÆ.

Soap-berry, the common name of several species of *Sapindus,* and of the fruits, which are so rich in saponin that they were employed for the same purposes as alkaline soap, before the days of that article. The Chinese prefer them even yet for cleansing the hair and delicate silks. Certain species of *Sapindus* yield also an edible pulp, although the seeds are poisonous. One species (*Sapindus utilis*) has been cultivated in Algeria for its berries, which the trees begin to bear in from 8 to 10 years; and *S. mukorossi,* another Chinese species, is found in Japanese gardens. Our two United States species have this saponaceous quality also, and the berries of *S. saponaria,* indigenous to tropical America and the West Indies, and even growing in Florida, are much used for washing linen, although said to be injurious if employed too frequently. The hard black seeds form beads for rosary and necklace. *S. acuminata,* a tall tree in the southwestern States, with abruptly pinnate leaves, has reddish brown berries, as large as cherries, with a soapy pulp; the wood is hard and strong and is made into cotton baskets and pack saddles. The East Indian *S. trifoliatus* has been used as a detergent, and the pulp as an astringent and tonic, the seeds themselves yielding a medicinal oil.

Soap Bubbles, in their scientific aspect, have been studied specially by Plateau, who, by adding glycerin in a certain proportion to the soap solution, obtained remarkably durable films and bubbles. The spherical form of the ordinary soap bubble is a direct result of the action of surface tension, the geometrical condition being that with given volume the surface must have minimum area.

Soap-plants, numerous plants, of various families, that contain a poisonous principle called saponin, which lathers in water, and is utilized as a detergent, both medically and for laundry purposes. The common soap-wort is the European *Saponaria officinalis,* often found in America along roadsides and railways, as a weed escaped from gardens. It is a rankly growing, smooth, and shining perennial, with the characteristic, opposite leaves, in this instance broadly oval, and five-merous flowers of the pink family. The obcordate petals are long clawed, with a scale at the base of each blade, ranging in hue from white to bright-rose color, and the dense terminal corymbs would be handsome were they not marred by fading flowers and brown seed-capsules. The thick roots and leaves abound in saponin, and besides its employment in the laundry, the plant was formerly used as a cure for itch; it also yields an alterative drug resembling sarsaparilla. The cow-herb (*Vaccaria vaccaria*) also contains saponin. Soap-bark or quillai-bark (q.v.) is a stimulant and irritant drug, the brownish-white cortex of *Quillaia saponaria,* a smooth evergreen tree native of Chile, where its inner bark, reduced to powder, is a substitute for soap. *Pithecolobium* of several species are leguminous trees, one the savonette or shagbark of the West Indies, which yields other soap-barks, in demand for cleaning delicate fabrics. There are also several Chinese trees, which serve the natives for soap, especially valuable in washing silks and the hair. The fruit of *Pancovia delarayi,* of China, resembles the soap-berry (q.v.), and the pods of *Gymnocladus chinensis,* and certain species of *Gleditschias,* give more substitutes for soap The refuse or "oil cake" of the seeds of the tea-oil tree (*Camellia sasanqua*), after the oil has been expressed, is not only employed in washing, but for catching fish. When the seeds or the oil cake are bruised and thrown into water the poisonous saponin stupefies the fish, which rise to the surface, and are easily captured.

Amole is a Mexican name covering several plants having saponaceous and cleansing properties and utilized by the natives of Mexico and the adjacent regions of the United States. *Agave heteracantha* is a common example. The Californian soap-plant, or soap-root (*Chlorogalum-pomeridianum*), is a liliaceous plant, with wavy-edged, linear leaves, and a tall branching panicle, of many white flowers. The root is a bulb one to four inches in diameter, invested with dark-brown fibres. This bulb is pounded up by the Californian aborigines, who throw it

Digitized by Google

into pools where fish have no means of escape, stupefying and capturing them. Hot soap-root is used to cleanse and heal old sores as well as in the laundry. There are several other soap-plants, as *Zygadenus fremontii*, and *Leucocrinum montanum* in California, and *Acacia concinna*, the soap-nut, the pods of which are used in India as medicines and detergents, especially in hair washing.

Soapstone. See TALC.

Sobaipu'ri, a former tribe of the Piman stock of North American Indians in the main and tributary valleys of the Rio San Pedro and Rio Santa Cruz, and on the Gila between those two streams in southern Arizona. The Jesuit missions of Guevavi, Suamca, and San Xavier del Bac were established among them in the latter part of the 17th and the early part of the 18th centuries, but owing to the depredations of the Apaches they were forced to abandon their rancherias and to join the Pimas, by whom they were absorbed.

Sobat (sō-bät') **River,** Africa, a tributary of the White Nile, rising in southwestern Abyssinia, flowing westward, and joining the main stream about 450 miles south of Khartum. It is a wide, deep and rapid stream, bringing down large quantities of sediment of a whitish color, whence, probably, the name of the White Nile. At the confluence the two rivers meet each other from opposite directions, and the sluggish current of the White Nile is often stemmed and forced back by that of the Sobat, forming a temporary lake.

Sobbing, a convulsive heaving of the breast; a heavy sigh, attended with weeping. It is essentially a respiratory act, depending immediately on nervous irritation, and caused by spasmodic movements of the diaphragm or midriff, but ultimately due to strong emotion, usually painful, though often merely hysterical. In sighing the glottis is temporarily closed, and thus prevents entrance of air into the lungs.

Sobieski, sō-byĕs'kē. See JOHN III., SOBIESKI.

Socage, sŏk'āj, or **Soccage,** a tenure by any certain and determinate service. It is of two sorts — free socage, where the services are not only certain but honorable, and villein socage, where the services, though certain, are of a baser nature.

Social and University Settlements. The settlement is one of the manifestations of certain ethical, spiritual and democratic beliefs which have for many years agitated some of the best men and women of England. Arnold Toynbee, an Oxford tutor, from whom Toynbee Hall, the first university settlement, derived its name, died in early manhood, in the year 1883. His short life was an intense one, absorbed in social questions and proposals for their solution. One or two of his «long» vacations were spent among the poor of East London. About 1838 Toynbee's father, a well-known aurist in London, had assisted Joseph Mazzini in his work among the immigrant Italian workingmen, who had come to England of their own free will or who had been brought there by that outrageous system of «white slave traffic,» which has been so strikingly described by Mazzini. During the several decades from this time on to the origin of the settlement movement, many of the most prominent teachers and preachers were engaged actively in promoting the growing spirit of democracy. Charles Kingsley, one of the foremost preachers of this new movement, gave it expression in the following words: «This bond of neighborhood is, after all, one of the most human; one of the most divine of all bonds; every man you meet is your brother and must be for good or evil; you cannot live without him and you must help or injure each other.» Many of Dickens' novels treated of social problems. Carlyle was bitterly denouncing forms of social injustice. Thomas Hughes added his voice to the protest. And that great teacher, Doctor Thomas Arnold, voiced the same feeling when he said:

> It seems to me that people are not aware of the monstrous state of society, absolutely without a parallel in the history of the world, with a population poor, miserable, and degraded in body and mind, as if they were slaves, and yet called freemen. And the hopes entertained by many, of the effects to be wrought by new churches and schools, while the social evils of their conditions are uncorrected, appear to me utterly wild.

Thomas Hill Green and John Ruskin were sending out men from the universities imbued with the new point of view. There were many other teachers, but these were perhaps the foremost, and all of them felt more or less with Ruskin when he said:

> I simply cannot paint, nor read, nor look at minerals, nor do anything else that I like, and the very light of the morning sky, when there is any — which is seldom, now-a-days, near London — has become hateful to me because of the misery that I know of, and see signs of, where I know it not, which no imagination can interpret too bitterly.

There was in England a growing sense of social duty and responsibility. Actuated by this impulse, Edward Dennison, an Oxford man of a well-known family, had gone in 1864 to live in a poor quarter in East London. The Working Men's College had been, even previous to his coming, established. In 1871 Arnold Toynbee, coming as a lecturer from Oxford, gave several addresses before the working men's organizations in London and in the provinces. He was admired by the working men, and both admired and loved by his friends at Oxford, where he dominated the little group gathered about him with his brilliant ideas upon the future of the working classes and the possibility of a social democracy. He died after delivering a lecture to some working men in 1883.

It was Toynbee's spirit, and ideas, more than any work which he individually accomplished, that gave to the settlement movement, the impulse which has enabled it to be a most remarkable expression of a deep and abiding sense of social obligation. And in this lies the greatest and the most distinctive quality in the settlement movement. It is not the institution, the clubs, and classes and kindergartens, but it is the spirit, which Toynbee had to an impressive degree, which is the essential value to the world of the settlement movement. Canon Samuel A. Barnett, rector of Saint Jude's Parish in the Whitechapel district of East London, is more responsible than Toynbee for the settlement as an institution. It is quite possible that the settlement movement might never have come into existence had it not been for Canon Barnett's ideas and his life, as indeed it might not have

Digitized by Google

come into existence had it not been for Toynbee's personality and his death.

At any rate, after Toynbee died, Canon Barnett, in an address before St. John's College, Oxford, outlined a proposed settlement of university men. The whole of England was stirred at that time by the riots of the unemployed, by the stories of suffering and starvation on the east side and by the publication of a little pamphlet called 'The Bitter Cry of Outcast London.' It was Canon Barnett's plan to have a house or «Hall» built some place on the east side in which university men might live and do work of various kinds for the benefit of the neighborhood. Several men volunteered to live for varying periods of time at this hall after it was established. Almost the same year a similar settlement was founded in London and at present there are 30 or 40 such settlements in England. There are upward of 80 so-called settlements in America. The first to be established here was the «Neighborhood Guild» of New York, begun by Stanton Coit, who had received his impulse from the founding of Toynbee Hall. It was afterward called The University Settlement. The «College Settlement» was founded at almost the same time in New York, and «Hull House,» the greatest American settlement, was founded in 1889 in one of the poorest districts of Chicago. The *Université Populaire* and the *Œuvre de Popincourt* in Paris are similar in their educational work to the university settlements. The *Ouis Huis* of Amsterdam, Holland, is also similar. There is a missionary settlement in Bombay, the «House of Neighborly Love» in Kyoto, Japan, and Kingsley Hall in Tokyo. There is also a settlement at Sydney in New South Wales called «The Toynbee Guild,» founded by an Oxford man.

Toynbee Hall has at present 23 residents, all university men. It is undenominational and nonpartisan. There are liberals and conservatives, progressives and moderates, churchmen and nonconformists, residents of no professed belief, and there is one Hebrew, all working together in a common spirit for the welfare of the neighborhood. Toynbee Hall does a great deal of educational work. It has lecture rooms, class rooms, laboratories, studios, club rooms; it has a picture exhibition, a good museum and a public library. There are reading circles, literary clubs and opportunities for various kinds of other educational work. On the social side of its work, there is a great deal done among the neighbors to enliven the social life. The «Smoking Debates,» which are educational and social in their design, are undertaken weekly. From 200 to 250 working men attend with interest and take part in these discussions. There are many conferences held on subjects connected with the welfare of the district such as housing, poor law reform, organized labor, management of schools, etc. The residents, a number of whom are mainly occupied in their own business affairs during the day, are, however, usually active on committees of reform bodies or represent the district on certain public bodies.

Mansfield House, a university settlement in Canning Town, is one of the most interesting settlements in London. Both here and at Oxford House active religious work has been undertaken. The Sunday afternoon men's meeting is one of the most powerful religious efforts being made in that community. In 1898 there was a pastor at the house, Leonard Robjohns, whose religious work was of singular power and usefulness. The former warden, Percy Alden, has been active in politics. For several years he was on the Town Council and for about a year he occupied the position of Deputy Mayor. One of the most interesting activities is «The Wave» lodging-house for the dockers who were formerly, if they are not now, the lowest class of English casual laborers. The house has representatives on the school board, the board of guardians, and has been active in various other ways in the public service.

In America the University Settlement of New York, while not doing work as extensive as that of Hull House of Chicago, is perhaps the most prominent settlement in New York. About 10,000 working people come there weekly to clubs, classes and meetings of various kinds. Its educational work has never been very strongly marked. The social efforts, in the way of clubs organized in the «Guild,» have always been a dominant feature. Several trade unions and the most important labor body of the city meet in the building. There are about 12 men in residence.

The most distinctive work being done in New York is perhaps that of Miss Lillian D. Wald and her associates at the Nurses' Settlements. Starting with the work of nursing, it has developed into a settlement movement which is quite unique. There are several small houses, in various parts of the city, under the direction of Miss Wald, in which nurses and other residents live. The able personality of Miss Wald is the real force which has made possible the remarkable settlement work which has been carried on. It is a much more personal work than that done by other settlements, the reason for which can be seen in that a part of it, at least, grows out of the nursing activities. On the other hand, it does important public service of a general character and has been of great value to various reform movements.

A combination of the work done at the University Settlement with the personal power of Miss Wald's group would perhaps be necessary in order to have a New York «Hull House,» even if it were then possible without the remarkable genius of Miss Addams. Hull House of Chicago consists at present of a striking group of buildings occupying a plot of land as large as some of the smaller New York blocks. There is the main house for residents, a building which is occupied by a co-operative club of working girls, a gymnasium building, with baths, given over, with the exception of the one floor, to a labor museum and various industrial activities, the most important of which is Miss Starr's bookbindery. There is spinning and weaving, pottery-making, wood-working, metal-working and cooking. While book-binding is one of the oldest crafts undertaken in the house, the printshop is a very recent addition. There is a small but beautiful theatre, a large restaurant, men's club rooms, a whole building given over to the music-school and work with children, and a group of buildings with apartments and lodgings. A bulletin of the activities of Hull House consists of a closely printed pamphlet of 12 pages. The Sunday evening lectures, upon a great variety of subjects are free. In the audi-

Digitized by Google

torium there are several dances a week, and many large parties and meetings. There are Sunday afternoon concerts where an effort is made to give the best music to the neighborhood. There are advanced classes in French and German, in the history of Art, and in Dante. There are secondary classes in a variety of subjects, including English, geography and literature. There are a great number of art and technical classes, including newspaper illustrating, sketching, drawing, painting, clay modeling, carpentry and wood carving, metal work, millinery, dressmaking, etc. There are numerous dancing classes and children's choral classes. The gymnasium is immensely popular, and there are daily afternoon and evening classes. There is an extensive play-ground for all sorts of athletic sports, including, of course, skating in the winter. Among the clubs, the most prominent is the Hull House Women's Club, numbering 327 members in good standing. There is a very remarkable list of lectures given during the year, and a large number of committees are appointed to work actively in certain public movements. The Hull House Men's Club is also an important organization. The Dramatic Association is an organization for the purpose of producing plays through the amateur talent of the house. There are a great many other clubs for young people and children. A number of organizations meet regularly at Hull House, including the Chicago Arts and Crafts Society, the Italian orchestra, the 19th Ward Improvement Association, etc. There is a kindergarten, nursery, Penny Savings Bank, visiting nurse and visiting kindergartner, the latter for sick or crippled children, and an agent of the Juvenile Court who works constantly among the dependent and delinquent children. A number of investigations are carried on each year in connection with definite social reform movements and many conferences on public questions are held. It would, however, be impossible in limited space even to mention all of the various activities.

In addition to what may be called the purely institutional work of the settlements, is the general work of a social and public character. There have been important investigations carried on which have resulted in many useful reforms. The Tenement House inquiry in Chicago was first undertaken by the settlements. The 'Hull House Maps and Papers' contains much valuable sociological material. Robert A. Woods of Boston has in the last few years made a remarkable study of that city and published two volumes with the results of his inquiries. 'The Jew in London' is a study made by two residents of Toynbee Hall. The work of the Child Labor Committees of both New York and Chicago is being largely carried on by the residents in settlements. In nearly all settlements there are residents doing important public work and serving on reform bodies of various kinds.

Miss Addams has divided the motives which constitute the subjective pressure toward social settlements into three great lines:

> The first contains the desire to make the entire social organism democratic, to extend democracy beyond its political expression; the second is the impulse to share the race life, and to bring as much as possible of social energy and the accumulation of civilization to those portions of the race which have little; the third springs from a certain renaissance of Christianity, a movement toward its early humanitarian aspects.

This spirit of democracy, or whatever it is, is, after all, the great thing in the settlement movement. The various kinds of activity, whether of a purely local or public character, are of little value compared with the spirit of the men and women who live and work in the settlement. The difficulty of keeping the movement democratic is seen in all parts of the country, especially where the body, controlling the life and spirit, and even the existence of the settlement, is no part of the movement and exercises dominance through Boards, meeting often in other parts of the city. The temptation to become an institution, to have buildings and property, is a real danger to the movement because it necessitates dependence upon persons often unsympathetic with the democratic idea. If the settlement becomes a mere institution of a charitable and philanthropic character, it will doubtless do much good, but it will fail to fulfil the promise which it gave to the world in the beginning; namely, to work for and to preach the spirit of universal brotherhood and the spirit of universal democracy.

Bibliography.— Addams, 'Subjective Necessity for Social Settlements, and Objective Value of Social Settlements, being essays in Philanthropy and Social Progress'; Barnett, 'Practicable Socialism'; 'Settlements of University Men in Great Towns'; 'Bibliographical Index, on Settlement Movement,' in each issue of 'Municipal Affairs,' 'Quarterly,' published by Committee of the New York Reform Club on Municipal Administration, especially in issue of March 1897; 'Bibliography of College, Social and University Settlements,' editions of 1893 and 1895 edited by M. Katharine Jones, edition 1897 edited by John Palmer Gavit; 'The Commons,' a monthly record, devoted to aspects of life and labor from the social settlements point of view, Chicago; Coit, 'Neighborhood Guilds'; Bliss, 'Encyclopedia of Social Reform' (1897); Goodale, 'Literature of Philanthropy'; Henderson, 'Social Settlements' (1898); Knapp, 'The Universities and the Social Problem' (1895); Reason, 'University and Social Settlements' (1898); 'Social Settlements,' advance almanac for 1900; 'Social Settlements and the Labor Question' (addresses by leading American Settlements Workers), pamphlet, reprinted from the Proceedings of the Twenty-third National Conference of Charities and Correction, Grand Rapids, Mich. (1896); Woods, 'English Social Movements.'

ROBERT HUNTER,
University Settlement Society, New York.

Social Brethren Church, The, a religious organization formed in 1867 and comprising churches and congregations in Illinois, Arkansas, and Missouri. The Confession of Faith published in 1887 provides for Baptism and the Lord's Supper as in other Evangelical churches. The Church has ordained and licensed ministers, and also exhorters, stewards, and deacons.

Social Contract, a general term applied to that imaginary bond of union which keeps mankind together. Jean Jacques Rousseau (q.v.) maintained that the natural and proper state of man is the savage state, when he possesses complete liberty, and that every social organization

Digitized by Google

is an infraction of natural right. All men he believed are born equal, and society is founded on a social contract.

Social Democracy, The. See SOCIALISM.

Social Democracy, German. See SOCIALISM.

Social Democratic Workingman's Party. See SOCIALISM.

Social Science, the science that deals with the social condition, the relations, and institutions which are involved in man's existence and his well-being as a member of an organized community. It concerns itself more especially with questions relating to public health, education, labor, punishment of crime, reformation of criminals, pauperism, and the like. It thus deals with the effect of existing social forces, and their result on the general well-being of the community, without directly discussing or expounding the theories or examining the problems of sociology, of which it may be considered as a branch.

Social Science Association, American. See AMERICAN SOCIAL SCIENCE ASSOCIATION.

Social Science, National Association for the Promotion of. (BRITISH.) See NATIONAL ASSOCIATION FOR THE PROMOTION OF SOCIAL SCIENCE.

Social Settlements. See SOCIAL AND UNIVERSITY SETTLEMENTS.

Social Service, the modern study of people and conditions looking toward the betterment of mankind; a forward movement dealing with life, occupations and environments, embracing the observation and investigation of the relation between employers and employees, co-operation, labor legislation, hours of work, wages, industrial betterment, child labor, factory sanitation and inspection, safety appliances, improvement of civic and municipal conditions, civil service, public ownership, the initiative and referendum, tax reform, marriage and divorce, housing, temperance, pauperism and crime, defective and delinquent children, education, social settlements, institutional churches and the like.

Social Revolutions.— During the 19th century there took place the two greatest revolutions in all history — one in the material world, created by the application of natural forces to industry; the other in the world of ideas, produced by the application of the scientific method to all processes of investigation. They have radically changed the methods of agriculture, of manufacture, of commerce, of travel, and of business; and they are radically changing the methods of charity, of philanthropy, of religion, of reform, and of education. It is difficult to name a single field of human activity which has not been profoundly influenced by one or both of these two revolutions. Together they have given to the world more knowledge and more wealth than all other instrumentalities employed in all the countless ages of the past. They have created in the Occidental world a new type of civilization, with which have obtained radically different conditions of life — in one word, a new environment which vitally concerns all classes. It is a fundamental law of nature that every form of life, whether vegetable or animal, individual or institutional, must be adapted to its environment. If the latter radically changes, the former must readjust itself or perish. Nature's method of readaptation is to kill off the unfit and to multiply the fit. This method is thoroughly effective, but it is fearfully costly in suffering and in life. Thousands of mechanics have lost their positions in recent years because they could not readjust themselves to the new methods of invention. Thousands of business men and manufacturers have been driven into bankruptcy because they could not adapt themselves to the new conditions by more economical methods of production and distribution. Thousands of clergymen have been laid on the shelf because they were unable to discern the signs of the times, and to adjust themselves thereto by adopting new and more effective methods. Thousands of churches have died because they did not know how to adapt themselves to their new environment. Many tens of thousands of men, women and children die needlessly in our cities every year because we have not yet learned how to adapt ourselves to the new conditions of urban life.

The process of readjustment is one of experiment. Each experiment, whether successful or otherwise, throws a ray of light on the problem of how to do it or how not to do it. Heretofore the world has been sadly slow to learn wisdom by experience. Succeeding generations have, for the most part, repeated the blind blunders of their predecessors. The facts of geology, though as common as stones and as conspicuous as mountains, were meaningless to men for thousands of years, because they did not know how to trace the relations of cause and effect. In like manner, the facts of human experience were common and obvious enough, but until modern times they yielded little wisdom, because without the scientific method men were able to trace only very imperfectly or not at all the relations between acts and their consequences. Experience signifies nothing unless we trace the relations of cause and effect. The science of statistics, by which facts are so gathered as to embody truth, and so interpreted as to afford knowledge, is of recent origin. It is a singular fact that our young republic was the first government in the world to take a census at stated intervals. Ships of state kept no logbooks. It is small wonder that so many split on the same rocks. Important as it is in social and political science to know precisely where we are, it is even more important to know the direction in which we are moving, for tendency is prophetic; and to establish a line of tendency we must fix more than one point; hence the value of a base line. Our decennial census during the 19th century established a base line 100 years long — the first in all history — from which we may measure in the 20th and in each succeeding century. Only in recent years have men learned to gather facts, to sift them, and correctly to interpret them, thus creating science. We are only beginning to construct the science of living, which is living in intelligent obedience to all natural laws; that is, all the laws which God has established both for the individual and for society.

Existing Evils.— There are many great evils incident to our present stage of industrial and social evolution on which no intelligent lover of his country and his kind can look with indifference. The widespread hostility, if not open conflict, between organized capital and organized

Digitized by Google

labor does violence to economic and social laws no less than to Christian principles. The reckless and increasing sacrifice of life and limb in American industry calls for such education of public opinion as will demand and enforce effective legislation touching accidents and their prevention. The victories of peace are even more bloody than those of war. There were not so many victims of the late Boer war as there were of American industries during the same period. In 1903 our railways killed or wounded 73,250 people. If to casualties on railroads we could add those in the mining, manufacturing, building and lumber industries, the totals would show a very considerable industrial army killed and a very large industrial army wounded every year. But only 9 out of 45 States require operators to report all accidents to their employees in factories and workshops; and the laws of no State require systematic returns of accidents in the building trades. A large proportion of these accidents might be prevented by the use of safety appliances and by the exercise of precautions which are entirely capable of legal enforcement.

The industrial revolution which has taken place in Western Europe and in North America is destined to encircle the globe. We have learned by costly experience many hard lessons which should be passed on free of cost to the younger industrial communities of the Old World. The blessings which the industrial revolution confers are immeasurable. It solves the problem of production, and creates abundance sufficient for all; it elevates the standard of living; it multiples wealth, and thereby gives a mighty impetus to education, science, art, architecture, and to all the refinements of civilized life. But on the other hand, it is attended by evils of scarcely less magnitude. It redistributes population, compacting masses in the city, creating the tenement house with its long list of evils, complicating the problems of sanitation, and raising the death rate. It assumes the role of Herod and slaughters the innocents, while the children who escape from the factory with their lives are commonly pinched and deformed in body and mind. It creates the popular discontent which inevitably springs from the multiplication and popularization of knowledge together with the multiplication and concentration of wealth. It is attended by the organization of capital and labor which are arrayed against each other in hostile camps. Now many of these evils are entirely preventable, though certain to be developed if neglected. They were permitted to fasten themselves on Western Europe and the United States because they were not foreseen. That excuse does not exist for the remainder of the world. With the opening of the Isthmian canal, northern capital, population and energy will flow into South America and inaugurate there the industrial revolution. It is already well under way in Russia and Japan, and is now beginning in China and India. Unless prevented by intelligent foresight, the evils which have thus far attended the industrial revolution will accompany it round the world and involve the hundreds of millions of these countries in sufferings as measureless as they will be needless. These peoples do not possess the power of self-restraint which has thus far preserved the balance— though a "hesitating balance"— in Western Europe and the United States. We are therefore bound by every obligation of humanity and religion to safeguard them with our experience, and thus forestall preventable evils, which if not thus prevented will be far more disastrous in the Orient than they have been in the Occident.

The Musée Social.— The section of Social Economy in the Paris Exposition of 1889 was peculiarly rich in documents relating to the conditions of labor and to workingmen's institutions. This exhibit made permanent was the origin of the Musée Social. Endowed with adequate funds, it is devoted solely to the promotion of the study of labor problems and the advancement of concrete measures of labor reform. As regards its organization and purpose it exemplifies in the field of economic research very much what the Smithsonian Institution in Washington does in the domain of scientific investigation. Both were founded by private individuals "for the diffusion of knowledge among mankind." Both are non-scholastic in the sense of having no regular classes of students, and both maintain a corps of experts devoted to original research and to the aid of those making similar inquiries. The Musée constitutes a veritable laboratory for economic research in all fields as far as they relate to concrete labor problems. In the language of its constitution, its object is "to place gratuitously at the disposition of the public documents with collateral information, constitutions and models of institutions, and undertakings having for their aim the improvement of the moral and material situation of the laboring classes." To carry out this aim the Musée has spared neither pains nor expense in the organization of every possible means of obtaining information concerning labor and labor conditions in all lands and in facilitating its use by all those interested in matters of social reform. It is well installed in a building owned by it at 5 Rue Las Cases, where it has lecture rooms, meeting rooms for the economic and reform societies of Paris, exhibition rooms for the display of plans, models, and accident-preventing appliances, and its carefully selected library. This includes over 15,000 volumes exclusively devoted to labor, and consisting largely of original sources of information, reports, and proceedings of societies and social undertakings which are not to be found in ordinary libraries. Its files include records and copies of labor legislation in all countries and of important labor events, catalogued and under the direction of skilled librarians, whose duty it is to help investigators desiring to make use of such material. The Musée, however, is not content with bringing together the results of others' efforts. Each year it sends one or more commissions to investigate particular features of the labor problem in foreign countries. It has thus made detailed investigations of trade unions in Great Britain, labor organizations in the United States, co-operative and credit institutions in Italy and the agrarian question in Germany by special delegates sent to those countries. In addition to making these special inquiries, it maintains in foreign countries special correspondents whose duties are to supply the Musée with copies of all bills, reports or laws concerning labor matters presented in their respective countries or of privately published works concerning labor, to furnish information as called for, and to transmit annual reports giving a *resumé*, with documents, of the labor events, legislation and judicial decisions relating to labor during the year.

Digitized by Google

What is said above of the Musée Social is summarized from a special report prepared by William Franklin Willoughby, then the American correspondent of the Musée Social.

The American Institute of Social Service.— With much the same purpose as the Musée Social of Paris but with a wider field was the League for Social Service of New York City. The League was organized in New York in 1898 by Josiah Strong and William H. Tolman, who became its president and secretary, respectively. The League, reorganized, enlarged and incorporated, became known in 1902 as the American Institute of Social Service, with headquarters at 287 Fourth Avenue, New York. The three functions of the Institute are: (1) To gather from all possible sources facts of every kind which bear on social and industrial betterment. (2) To interpret these facts by ascertaining their causes and effects, thus gaining their real significance, and (3) to disseminate the resulting knowledge for the education of public opinion, with an educational charter from the Regents of the University of the State of New York.

The work of the Institute is divided into 11 departments, as follows: (1) Bureau of Information; (2) Investigation; (3) Illustration; (4) Publication; (5) Legislation; (6) Lecture Bureau; (7) Library and Archives; (8) Museum of Security; (9) Personal Study and Research; (10) International Relations; (11) Relations with other Societies. Other departments are likely to be added with the further development of the work.

The American Institute of Social Service is collecting a great mass of facts from Europe, as well as America, which embody experiences of many millions of people; and these facts scientifically interpreted throw light on many social problems, new and old, and afford practical guidance in the conduct of life, and in the establishment of right relations between man and man. In response to inquiries, the Institute's bureau of information is constantly sending materials bearing on social and industrial betterment to newspaper men, ministers, students, teachers, authors, legislators, and the like. When a corporation desires to improve the condition of its employees, the Institute can furnish facts and photographs showing what is being done along these lines by many of the world's great captains of industry, such as Krupp of Essen, Casimir-Perier of France, Van Marken of Holland, Cadbury of Birmingham and Lever of Liverpool, describing their improved housing, their sanitation, their hospitals, homes for convalescents, schools, kindergartens, athletic grounds, parks, baths, swimming pools, systems of insurance, old age pensions and the like. Again, a city desires to improve its municipal housekeeping, and would like to learn from Glasgow as a model. It is not necessary for Cincinnati or Chicago to send a committee of investigation to the Scotch metropolis. The Institute can send Glasgow to Cincinnati or Chicago and by means of hundreds of lantern slides, show her improved tenements, her street-cleaning system, her playgrounds, her out-of-door gymnasia, her hospitals, her park system, etc. A church which is struggling to adapt itself to a changed environment wishes to know how certain problems have been solved. The Institute can give information of scores of churches which have successfully adjusted themselves to new conditions and whose experience will probably afford the desired solution. The existence of 45 States with their separate legislatures, affords a vast field for social service by helping all to profit by the experience of each. Most of the great problems of all the States are substantially the same, as in the case of pauperism, crime, defective and delinquent children, roads, the relation of labor and capital, and the like. Some States are much in advance in one particular, others in another. What if, in each particular, all the States could be brought up to the standard of the most advanced State; how would the nation leap forward in civilization? For instance, the experience of several States has demonstrated the value of juvenile courts and of industrial legislation for children. In the natural course of things it takes years for such reforms to reach the more backward States; whereas the Institute, with the necessary funds, could doubtless educate public opinion so as to secure the desired legislation in one quarter of the time. As President Roosevelt says in a letter to the Institute: «The possibilities of the Institute are well nigh boundless. It is apparently proving to be the beginning of a world movement, and is being recognized by the best men of many different countries as a necessity in each and all of these countries in order to facilitate a readjustment of social relations to the new conditions created by the modern industrial revolution.»

The Dunfermline Experiment.— In 1903, Andrew Carnegie (q.v.), the philanthropist, placed in trust the sum of $2,500,000 for the purpose of beautifying and improving his native town of Dunfermline, Scotland, and the American Institute of Social Service outlined a plan of procedure for this important work. The plan includes a regional museum, a district for a «city beautiful,» a social centre, a department of civics, boys' and girls' flower gardens, children's playgrounds and out-door gymnasia, holiday tours and historic pilgrimages, «get-together club» and a system of awards and prizes. The general outline for a city beautiful suggests that somewhere in the confines of the park land should be set aside on which can be built model dwellings of diversified architecture. One house should be set aside as a working model, furnished throughout with all necessaries and as many comforts as are demanded by a modest taste. By means of this model house, clerks, artisans and laborers may be shown how to furnish their homes. Under this plan the social centre should be a building located in the park, easily accessible, so as to be a resort for all the people — children for the most part by day, adults at night and on holidays. It should contain a hall for music, speaking, dancing, flower shows and other entertainments. There should be classrooms for instruction in music and art in its various branches. In a regional museum should be collected the various processes of local industries, in order that the individual workman may get an idea how his part in the process is related to the great industry as a whole. The department of civics is intended to inspire youth and to direct their enthusiasm wisely, so as to raise the tone of their citizenship.

JOSIAH STRONG,
President American Institute of Social Service.

Socialism is a word having two distinct but related meanings: primarily it is used as the

Digitized by Google

name of a certain philosophy of history and method of interpreting and analyzing social phenomena. In the second place, since this philosophy and method have as one of their principal conclusions that society is evolving toward a co-operative social stage the word is used to designate a co-operative social organization where the means for the production and distribution of wealth are the collective property of the working class, while the goods which are to be consumed become the private property of the individual workers. The philosophy of socialism, as generally accepted by the socialist parties of the world at the present time, takes as its fundamental hypothesis what has been variously called, the materialistic interpretation of history, historic materialism, or economic determinism. This doctrine is stated as follows in the 'Communist Manifesto':

> In every historical epoch the prevailing mode of economic production and exchange, and the social organization necessarily following from it, form the basis upon which is built up, and from which alone can be explained, the political and intellectual history of that epoch; and consequently the whole history of mankind since the dissolution of primitive tribal society, holding land in common ownership, has been a history of class struggles, contests between exploiting and exploited, ruling and oppressed classes; the history of these class struggles forms a series of evolution; now-a-days, a stage has been reached where the exploited and oppressed class — the proletariat — cannot attain its emancipation from the sway of the exploiting and ruling class — the bourgeoisie — without at the same time, and once and for all, emancipating society at large from all exploitation, oppression, class-distinctions, and class-struggles.

It is maintained that the form in which production is carried on in any society constitutes the fundamental fact which determines all other social institutions. This does not hold that each economic era begins *tabula rasa* in the field of institutions. Each historical stage inherits its institutions from the previous stage and it can only influence, change, and reconstruct these or establish new ones alongside of them. These inherited characteristics include customs, laws, ethical standards, public opinion, and in short the whole set of institutions and social psychology which has been built up throughout the course of human evolution. The analogy between heredity and environment in biology and in the social organism is here very close. Since the appearance of the institution of private property in the instruments by which wealth is produced and distributed, society has necessarily been divided into two classes according as their members own or do not own these essentials for the production of wealth. The struggle of these classes for power constitutes a large portion of the history of modern times. In the Middle Ages, land being the most essential instrument for the production of wealth, the landlords were the ruling class and social institutions were determined by them in accordance with their interests. When the great transformation of hand tools into factory machinery took place at the close of the 18th and beginning of the 19th century, this machinery of the modern factory became the most essential element in the production of wealth, and its owners became the ruling class.

When the owners of industrial capital had gained their victory they set about establishing a society in accordance with their interests. They formed at this time the class most necessary to the basic industrial processes of society, since the accumulation and organization of capital was the most essential thing at this historical period. Later on the capitalist class laid down its function as organizer and director of industry and became simply a share-holding class. Hired wage-workers, including manual laborers, overseers, bosses, and superintendents perform all the essential social processes. The capitalist class having handed over its function to the working class, the latter becomes not only the most essential, but the only essential class. The material interests of this class involve it in continuous struggles with the capitalists. Sooner or later this struggle is transferred to the political field where the laboring class is represented by the Socialist Party, having as its object the capture of the powers of government and social control in order that it may use them in the interest of that class.

According to this philosophy the social dynamic which compels advance is the continuous improvement of the processes of production. Every new invention and every improvement in the organization of industry starts in motion a series of influences which do not cease until they have reached and affected every institution within the society of which they form the industrial basis. During the last 100 years mechanical improvements have multiplied many fold the productive power of each individual worker. But the army of unemployed prevent the price of labor power as a whole from rising much above the point necessary to maintain the efficiency of the wage-worker as a producer. Consequently the workers who use these improved instruments receive but a small fraction of the greatly multiplied product. They have no choice under the present system but to accept these conditions. While production is for sale in the competitive market only the cheapest can continue to produce. If the workers are to produce, and they cannot live without producing, since they have no power of ownership to take from other producers, they must gain access to these highly perfected tools. Hence they compete with one another for the privilege of using them, and of selling their labor-power to the owners of the tools. They finally accept a wage-contract by which, for the privilege of producing their own wages during the first hour or two of work, they continue at work for many hours more, producing surplus value for the owner of the means of production which they use.

Improvements in production often take other than mechanical forms. The modern trust is, to some extent, to be considered as such an improvement. Socialist writers pointed out over a half century ago the self-destructive character of competition. It was then foreseen that one of the inherent characteristics of large industry was its greater economy as compared with smaller competitors. Consequently the large industry tended to eliminate all smaller competitors within the circle of its market. Improvements in transportation, communication, and storage rapidly extended the circle of the market to national, and for some products, at least, to international dimensions. When, however, there are sufficient plants constructed to more than supply any circle of the market and competition is reduced to a few industrial units, the wastes of

Digitized by Google

competition and the destructiveness of competitive war become so evident that combination is inevitable. The result is some one of the various forms of combination by which competition is stifled and monopoly established.

The wage-workers seek political victory in order that they may impress their interests upon the social organism and thereby remove the evils under which they suffer at the present time. Since most of the evils of which they complain spring from the fact that they are debarred from access to natural resources and the instruments for the production and distribution of wealth, their first demand is that such access be freely granted. But free access implies legal ownership and with modern concentrated complex industry this ownership cannot be individual unless all the evils of the present system are retained. Hence, we have a demand for collective ownership.

Thus socialism as a philosophy is mainly an analysis of capitalism. As an ideal, as a social stage, it presupposes the capitalist system, since that can alone prepare the way for socialism. This future system, or ideal, is in no sense of the word a scheme whose adoption is asked for by the Socialists. It is simply the next logical stage in social evolution. Socialists do not attempt therefore to give any details of that future society since all such details will be dependent upon the decision of a majority of the working class of that future time, and upon the stage of industrial development which has been attained when socialism is ushered in. Since both of these factors are manifestly impossible of being known at the present time, any attempt to forecast their outcome would be equally impossible. All that can be said is that present tendencies of social development show what must be a few of the general features of the next social stage.

Socialists maintain that the coming society will be preferable to the present one, especially for the working class. With a collective democratically managed organization of industry, in which natural resources and the mechanical means for the production and distribution of wealth have their ownership vested in society, and where production is for the direct use of the producers and not for sale, the wastes of the present system will be largely abolished. Among these wastes which will be abolished are advertising, duplication of plants and power, poor utilization of mechanical progress, disadvantageous geographical location of industries, etc. Some of these are already being abolished by the trust method of production. But at the present time the saving accomplished redounds almost wholly to the benefit of the few owners of the trustified industry. In addition to this Socialists maintain that much greater savings would be made under socialism by the utilization in productive labor of the energies of whole classes of the population from whose strength and ability society, at present, derives little or no advantage. This would be true, for example, not alone of the present army of the unemployed amounting in the United States to between one and three million, according to industrial conditions, but also the purely capitalist class whose function of ownership being performed collectively would enable the members of that class to directly assist in production. By far the larger share of that portion of the population concerned in the protection of individual property rights in what socialism would make collective property, such as lawyers, judges, police, private watchmen, detectives, and the army and navy, would also be capable of utilization in the production of material wealth.

Socialists also claim that in a co-operative society the sum total of human happiness would be immensely increased by making the production of goods in itself pleasurable. When profit and the competitive struggle are abolished and productive energies fully utilized there will be a possibility of that leisurely artistic creative activity which modern psychology and pedagogy agree is capable of furnishing the most intense pleasure and valuable educational training to the individual worker while, at the same time, producing the best possible goods for the satisfaction of human needs. It is this phase of socialism which has always attracted artists and has given rise to the now extensive arts and crafts movement. It is easy to see in this connection that socialism would offer a much greater field for the development of individuality than is possible for the great mass of the people to-day.

The theory of socialism is itself a product of evolution, the ideal appearing long before the philosophy of society and the scientific analysis of social relations which make possible the realization of that ideal were worked out. Ever since the days of Plato, and especially since the writing of Sir Thomas More's 'Utopia,' men have dreamed of a society which should be a co-operative brotherhood. During the latter part of the 18th and first half of the 19th century Utopian socialism reached a high degree of development and found numerous illustrious followers. Among these were Fourier, Babœuf, Saint Simon, and Cabet in Europe, and a few years later, Greeley, Dana, and Nathaniel Hawthorne in America would be largely included in this class. Robert Owen marked somewhat of an advance on this position. While he founded colonies and pictured utopias, he also set forth many ideas that have since become a part of modern scientific socialism. Lassalle, Rodbertus, and Weitling in Germany, Colins and De Paepe in Belgium also helped to some degree to formulate present socialist philosophy while they also partook of a Utopian character. It is with the work of Karl Marx (q.v.) and Frederic Engels (q.v.), however, that modern socialism began to definitely take on the forms by which it is known to-day. In 1845 Marx was ordered out of Paris and went to Brussels where he was joined by Engels and where they founded the "German Working-Men's Association" with the 'Deutsche Brüsseler Zeitung' as its organ. It was while here that they became members of the Communist League and wrote the 'Communist Manifesto,' to which reference was previously made.

A philosophical and a political goal presupposes an organization for propaganda and political activity. The body that is generally looked upon as the ancestor of the present world-wide Socialist organizations is "The League of the Just" organized in Paris in 1836. The aims of this organization were, however, very indefinite, and its principal significance lies in its transformation in 1847 into the "Communist League." This change was brought

Digitized by Google

about through the influence of Marx and Engels. While the "Communist League" exercised considerable influence on continental labor movements during the first two or three years of its existence, yet it was overwhelmed in the reaction which followed the revolutions of 1848, and by 1853 it had practically disappeared. Its great contribution to socialism lies in the fact that under its auspices was issued a document that for far-reaching consequences and lasting influence must be considered one of the most remarkable ever written. This was the 'Communist Manifesto' drawn up by Marx and Engels as a committee of the Communist League in 1848. This work consists of a summary of the philosophy of socialism and has been translated into almost every known language, and still constitutes the most generally circulated work on socialism in existence. New editions and translations appear continually throughout the world. The next great step was the organization of the International Working-Men's Association (q.v.) at Saint Martin's Hall, London, 8 Sept. 1864. A committee appointed by this meeting and composed of 50 members representing six nationalities presented a declaration of principles which was written by Karl Marx and which was unanimously accepted by the organization. Since this declaration has formed the basis of almost countless socialist platforms in different countries since that time, it is worth reproduction:

In consideration that the emancipation of the working class must be accomplished by the working class itself, that the struggle for the emancipation of the working class does not signify a struggle for class privileges and monopolies, but for equal rights and duties, and the abolition of class rule;

That the economic dependence of the working man upon the owner of the tools of production, the sources of life, forms the basis of every kind of servitude, of social misery, of spiritual degradation, and political dependence;

That, therefore, the economic emancipation of the working class is the great end to which every political movement must be subordinated as a simple auxiliary;

That all exertions which, up to this time, have been directed toward the attainment of this end have failed on account of the want of solidarity between the various branches of labor in every land, and by reason of the absence of a brotherly bond of unity between the working classes of different countries;

That the emancipation of labor is neither a local nor a national, but a social problem, which embraces all countries in which modern society exists, and whose solution depends upon the practical and theoretical cooperation of the most advanced countries;

That the present awakening of the working class in the industrial countries of Europe gives occasion for a new hope, but at the same time contains a solemn warning not to fall back into old errors, and demands an immediate union of the movements not yet united;

The First International Labor Congress declares that the International Working Men's Association, and all societies and individualities belonging to it, recognize truth, right and morality as the basis of their conduct toward one another and their fellow men, without respect to color, creed, or nationality. This Congress regards it as the duty of man to demand the rights of a man and citizen, not only for himself, but for every one who does his duty. No rights without duties; no duties without rights.

At the last European meeting of the "International," anarchistic forces under the leadership of Bakounin threatened to gain control, and in order to avoid this catastrophe the Socialists who were still in the majority voted to remove the headquarters of the organization from London to New York. There was another purpose in this also. It was felt by Marx and others that since the doctrines of socialism had been included in various national working-men's movements and had been somewhat systematized by the discussions of the congress, that the time for a great centralized organization was past, and that its disappearance would be the best thing possible. This ends the history of the socialist movement as one centralized organization, and it can henceforth be best studied in its various national manifestations.

Germany.— Owing to the fact that socialism in Germany was, to some extent, in advance of the movement in other countries its history is largely typical. It has also furnished many of the foremost writers and organizers of socialism and has, numerically, always been in the front rank of the International Socialist organization. For these various reasons, the German Socialist movement must occupy considerable space in any discussion of socialism. On the theoretical side it is commonly said that German socialism goes back to Fichte and Hegel for many of its premises. But the first writers who are directly linked with the modern doctrines of socialism in Germany are Professor Winkelblech, better known as "Karl Marlo," Rodbertus, and Weitling. Marlo developed the germs of the idea of collectivism and Rodbertus of surplus value and the doctrine of crises as due to over-production. But neither of them carried their ideas to a sufficient perfection to have in any way entitled them to recognition had it not been for the fact that owing to the work of later writers, and economic and political events, these ideas became of so great importance as to lead to the most diligent search into their origins. Wilhelm Weitling is much more closely linked both in doctrines and in activity with the modern movement than either of the others. From 1830 to 1843 he was active as a writer and agitator in Germany and Switzerland. He was arrested in 1843 and imprisoned. This was but the beginning of a systematic persecution which finally, in 1849, drove him to the United States where we shall hear from him again and where he died on 25 Jan. 1871. Yet after all, he was largely a dreamer and Utopian, and it is Ferdinand Lassalle who must really be looked upon as the founder of the German Socialist movement, even though little that was distinctly Lassallean in doctrine in his day, remains in the German Social Democracy. Lassalle was born at Breslau 11 April 1825, studied first at the Trade School at Leipsic and then took up philology and philosophy at Breslau and Berlin where he passed his examinations with distinction. The stormy times of 1848 drew him to the struggles of the working men and brought him slightly in contact with Marx and Engels, although there is little evidence that he was influenced by them at this time. Lassalle did little in the way of active agitation until 1862. He published 'The System of Acquired Rights,' containing many socialistic ideas, 1861. On 12 April 1862 he delivered before an Artisans' Association in Berlin his famous lecture on the labor programme (Arbeiterprogramm: über den besonderen Zusammenhang der gegenwärtigen Geschichtsperiode mit der Idee des Arbeiterstands). In this lecture he set forth many of the ideas that have since become part of the Socialist philosophy. The published copies of this lecture were at once seized and destroyed by the police and Lassalle was arrested. At his trial he delivered, as his defense, his now famous speech on 'Sci-

Digitized by Google

ence and the Workingmen' ('Die Wissenschaft und die Arbeiter'). The next step was taken in response to an invitation to address the Leipsic Workingmen's Association, one of the numerous rather indefinite labor organizations which were later destined to become of great importance in the German Socialist movement. Lassalle sent his 'Open Reply Letter.' In this he set forth his adherence to the Ricardian theory of the iron law of wages. He declared that the only solution of the poverty of the working class was the organization of productive associations of the workers for which the state must provide the necessary capital. To secure this end he declared that "the working classes must constitute themselves into an independent political party, and must make universal, equal, and direct suffrage their watchword. The representation of the working classes in the legislative bodies of Germany — that alone can satisfy their legitimate interests in a political sense." On 19 May 1863 the Congress of Workingmen at Frankfort-on-Main adopted Lassalle's program and four days later the "Universal German Workingmen's Association," which was later to develop into the German Social Democracy, was founded. Lassalle, however, was destined to see small fruits from his work. After a few months of tireless, energetic, eloquent agitation, with apparently small results, he was drawn into a duel on a purely personal matter, was fatally wounded, and died 31 Aug. 1864. For a time considerable confusion existed. The International Workingmen's Association, whose organization at London in 1864 has already been described, began to have an influence in Germany. Wilhelm Liebknecht was its principal worker. Many of the principles of the Marxian economics which had been accepted by the International, were opposed to the doctrines of Lassalle. This was particularly true of the state-assisted productive associations. In 1867 universal suffrage was granted for the North German Reichstag and the Socialists polled between 30,000 and 40,000 votes, electing six members, among whom was August Bebel, who has never ceased since then to play a prominent part in German Socialism, and who had been converted by Liebknecht to the Marxian position and the support of the International. In 1869 at Eisenach the Marxian wing organized the "Sozial Demokratische Arbeiter Partei." For the next few years the strife between the Eisenachers and the Lassalleans was fierce. This, however, did not prevent the rapid growth of Socialism, and in 1874 331,670 votes were cast for the Socialist candidates. Three Lassalleans and seven Eisenachers, including Bebel and Liebknecht, both of whom were in prison for alleged treasonable utterances during the Franco-Prussian war, were elected to the Reichstag. This great success brought down the wrath of the governing powers, and a period of persecution began, the first effect of which was to close up the breach between the two Socialist parties at the Congress of Gotha in May 1875. This union was followed by a rapid increase in the Socialist vote, which by 1877 had reached nearly 500,000. Meanwhile Bismarck was bending every energy to force repressive measures through the Reichstag. It is probable that he would have failed in this, had it not been that two insane persons attempted to assassinate the Emperor. Bismarck at once declared that these attacks were inspired by the Socialists, although there was never the slightest evidence to justify this assertion. However, he at once dissolved the Reichstag and by means of the most inflammatory appeals to public prejudice succeeded in getting a majority subservient to his purposes. A law was forced through which practically outlawed the entire socialist movement. It prohibited the formation or existence of organizations which sought by Social Democratic, socialistic, or anarchist movements to subvert the present State and social order. Provision was also made that where even these very stringent measures were ineffective, any city could be declared in a "minor state of siege" in which all public activity was directly controlled by the police. The Socialists at once determined upon a policy of "shamming dead." The organ of the Socialist Party was transferred to Switzerland and from there circulated in great numbers throughout Germany. The only attempt at public propaganda within Germany was through the speeches of the Socialist members in the Reichstag. At the first election taking place under this Reign of Terror in 1881, it appeared as if the policy of suppression was succeeding, as the Socialist vote fell to a little over 300,000. From that time on, however, and in spite of oppression, the party grew by leaps and bounds until in 1890 it polled 1,427,298 votes. It being manifestly impossible to continue to consider a million and a half of voters as outlaws, the anti-Socialist law was allowed to lapse in March 1890 and Bismarck was dismissed as minister. From that time to the present the Socialist movement has continued to grow.

THIRTY YEARS' GROWTH OF THE SOCIAL DEMOCRATIC PARTY.

Year	Popular Vote	Members
1871	124,655	2
1874	351,952	9
1877	493,288	12
1878	437,158	9
1881	311,961	12
1884	549,990	24
1887	763,128	11
1890	1,427,298	35
1893	1,876,738	44
1898	2,113,073	56
1903	3,008,000	81

France.—The French Socialist movement was for many years split into various factions, but within the last few years these have tended to concentrate more and more into two organizations representing distinct tendencies. On the one hand the Parti Socialiste Français, having Jules Guesde and Paul Lafargue as its most prominent representatives, is in direct accord with the Marxian movement throughout the world. On the other side is the Parti Socialiste de France, with Millerand and Jean Jaures as its principal leaders. This faction represents the extreme opportunist tendency, and many of the Socialists of other countries disavow this wing entirely. It has always been a fundamental principle of the Socialist movement that the Socialist could make no terms with existing governments; that their representatives took governmental positions for the purpose of propaganda to advance the interests of the working class, and that they were always in an attitude of hostility toward the

Digitized by Google

capitalist class character of such government. Millerand, however, in June 1899, became Minister of the Interior of the Waldeck-Rousseau Ministry. It was claimed that this compelled him to co-operate with and become responsible for the acts of the government as a whole while that government remained essentially capitalistic. In January 1904 Millerand was expelled from his party for having voted against a proposition for disarmament. The Socialist parties of France have been of rather recent date. The following table gives their vote from their first appearance to the present time:

	Pop. Vote	Deputies
1893	440,000	32
1898	751,554	38
1900	863,159	44

Belgium.— In Belgium there is but one Socialist Party, the Parti Ouvrier Belge, which was founded in 1885. For several years the franchise was very limited and the Socialists were barred from any effective political action. Accordingly the early years of the party were given up to agitation in favor of universal suffrage. This culminated in a series of great demonstrations and finally in the general strike in 1893, which resulted in the granting of universal suffrage to all males over the age of 25 years. This was much qualified, for in many elections there is a complex system of plural voting by which those possessing property or special educational qualifications have two or three votes, while the propertyless wage-workers have but one. Yet at the first election in 1894 the Socialist Party polled 320,000 votes and elected 28 deputies out of 152. In 1900 this was increased to 463,000 votes with 32 deputies and four Senators. The principal characteristic of the Belgian Socialist movement is the peculiarly close affiliation of the three phases of the working class movement, the co-operative, trade union, and political activity. Practically every trade unionist is also a Socialist and a member of some one of the co-operative organizations.

Holland.—The Social Demokratische Arbeiderspartij was organized in 1894. For some little time anarchist influences threatened to gain control, but in 1900 the anarchists, with their leader Domela Nieuwenhuis, were expelled from the old "Socialisten Bond" in which they had hitherto been dominant, and that organization merged with the Socialist Party. At this time the daily paper *Recht Voor Allen,* which had been founded by Nieuwenhuis, became a Socialist journal. The elections held in 1901, in which the Socialists contested 10 districts, resulted in the election of nine Socialists to the Lower House with a total Socialist vote of 39,000.

Denmark.— In Denmark the Socialist movement, like that of Belgium, is closely affiliated with the trade unions, and Denmark claims to be the most thoroughly organized country in the world, over 75 per cent of its working class, including rural laborers, being included in the unions. They also have a very strong co-operative movement in connection with the Socialist movement. The following table gives the vote since the formation of the party:

1872	268	1892	20,094
1876	1,076	1895	24,508
1881	1,689	1898	31,872
1884	6,806	1901	42,972
1887	8,408	1903	55,479
1890	17,232		

Sweden.— The principles of Socialism were first introduced into Sweden by August Palm in 1881. In 1889, at the first trade-union convention held in Sweden, the German Socialist programme was adopted, and the unions have ever since formed the backbone of the Socialist organization. The membership of the party now amounts to about 60,000 paying members. A property qualification of 800 kroners annual income practically disfranchises the entire laboring class. Notwithstanding, the Socialists succeeded in electing Hjalmar Branting to the Riksdag in 1902. A general strike was declared in order to secure universal suffrage. As a result, the amount of income required as a qualification was reduced, but other conditions were added. A system of plural voting exists in the municipal elections which has prevented the Socialists from electing any candidate, although many times a large majority of the population voted with them.

The Socialist press is extremely active. Twelve of the leading Socialist papers have 62,000 subscribers. Besides these, there are two juvenile papers, one humorous publication, and one of a general literary character conducted by the Socialists.

It is impossible to give any exact statistics of their vote, owing to the system of plural voting and property qualification, but it is generally estimated at between 75,000 and 100,000.

Italy.—During the time that the German Socialist movement was forming and the International was carrying the doctrines of socialism into various other European countries, Italy was still ideologically under the influence of the bourgeois liberalism of Mazzini, and conspiratory anarchism as represented by Bakounin. When these two movements died out, all activity among the laboring classes seemed to disappear, especially as all attempts at Socialist agitation were brutally repressed. A Socialist Congress under the honorary presidency of Garibaldi was held at Rome in February 1881. The socialism here set forth, however, was still very indefinite, the principal demand being for universal suffrage. In 1882, in response to an energetic agitation, the franchise was somewhat extended, but was still very restricted. Nevertheless the Socialists were enabled in 1883 to contest 13 districts and elect two deputies. The present Socialist Party was organized at Milan in 1891 and the organization perfected at Genoa in 1892. The first election in which it participated was in 1893, when 27,000 votes were cast. This was followed by a period of oppression under Crispi, in many respects analogous to that which took place in Germany under Bismarck. One phase of this, however, was somewhat different. Under the pretence of revision the electoral lists were so tampered with as to disfranchise thousands of Socialist voters, some of whom were even office holders and whose qualifications had never been challenged. So far was this carried that, in some districts which were known to be dominantly Socialist, almost the entire population was disfranchised. The Crispi ministry was wrecked on the Abyssinian expedition, and his successor, Rudini, somewhat relaxed the persecution. Two tendencies are apparent in the Socialist movement of Italy, as in several other countries. The orthodox Marxian wing has, as its principal representative Enrico Ferri, the well-known criminologist, who is editor of

Digitized by Google

‹Avanti.› The leader of the Opportunist group is Philippo Turati. One of the remarkable features of the Italian movement has been the hold which it has gained among the agricultural workers. This is due undoubtedly to the extremely pitiable condition to which these workers have been reduced. The following table gives the vote of the party with the members of Parliament elected since 1895:

1895	78,359	11
1897	120,000	16
1900	170,841	31

Spain.— Spain was one of the countries in which the influence of the «International» was strong. At a Congress held in Barcelona in June 1870, 40,000 members of the «International» were represented. Unfortunately the anarchist followers of Bakounin gained considerable influence here, as in Italy, and with the same result that the revolutionary movement well nigh disappeared. This, in spite of the activity of Paul Lafargue, the son-in-law of Karl Marx, to whom reference was made in the discussion of the French movement, and who was at that time living in Spain. In 1882, the present Social Democratic Labor Party was organized, and since then has taken part in numerous elections. At the latest report of the party there were 73 groups with about 10,000 members and a press of 13 publications. Pablo Iglesias is the most prominent member of the Spanish Socialist movement.

The following table shows the elections in which the party has participated:

1891	5,000	1899	23,000
1893	7,000	1901	25,000
1898	20,000		

Austria.— One of the great difficulties which has confronted the Socialist organizations of Austria has been the diversity of nationalities. Socialists have always insisted on discrediting all national antagonisms and jealousies, and as such have run counter to the strong national and race sentiments that exist in all classes of the population. A branch of the «International» existed in Austria in 1867, and in 1869 this organized a demonstration in which 100,000 men marched to the palace in Vienna to demand universal and direct suffrage, freedom of speech and association, and liberty of the press. This demonstration was met with profuse promises, but as soon as it was disbanded, its leaders were imprisoned and a period of brutal repression followed which momentarily annihilated the entire Socialist movement. The present party was organized at a Congress held at Vienna in 1888 and is closely united to a strong trade union movement. Its first effort was to obtain an extension of the suffrage and it was finally successful in gaining a sort of class representation by which the nobility and clergy form one class, the great capitalists the second, the small property owners the third, the peasant proprietors the fourth, and finally the proletarian wage-worker was made a fifth class. Each of these classes elect a certain number of representatives. This of course means that one man in the first and second class might easily outvote several thousand in the last class. Nevertheless at the first election held in 1897, 750,000 Socialist votes were cast and 15 deputies elected. In 1900 the second election was held in which wholesale intimidation and threats on the part of the governing classes resulted in the reduction of the Socialist vote to 600,000, and their representation to 11 deputies. A co-operative movement with 170 organizations including 53,000 members and with a capital of 17,000,000 kronen is affiliated with the Socialist party.

England.—Although it was in England that Marx, Engels, and Liebknecht wrote many of the classics of Socialism, and although England has been looked upon as the classic land of capitalism, still Socialism in England ranks far behind the movement of other countries which it might have been expected to surpass. This has received many explanations. Perhaps the most satisfactory of these is to be found in the fact that domination of the world market enabled English capitalists to grant small favors to her laboring class and thus prevent any broader demands. The Social Democratic Federation, which is the oldest of the English Socialist bodies, was organized in 1879, but did not become avowedly Socialist until 1883. The Fabian Society was organized 4 Jan. 1884. The Independent Labor Party was organized in Bradford in January 1893. The S. D. F. represents the International Marxian standpoint. The Independent Labor Party more of the Opportunist movement, while the Fabian Society is almost purely an educational organization. A recent development of considerable importance has been The Labor Representation Committee. This is an organization for the purpose of securing representation of labor in Parliament. In the beginning all three Socialist bodies were affiliated, but later the S. D. F. dropped out because the Committee refused to accept the Marxian position. This body, which is now largely controlled by the I. L. P., claims the adherence of 1,500,000 trade unionists. There has been a strong tendency however for this movement to grow away from the Marxian position, and many candidates have been supported by it who did not accept the entire Socialist platform. It is difficult to give any exact figures of the Socialist vote in England, since there has been no opportunity to test their strength by any general Parliamentary election. It is commonly estimated to be between 300,000 and 400,000, however.

Norway.— Capitalist development was late in appearing in Norway. Political attention was also focused largely on the question of the union between Norway and Sweden, so that it was really not until 1900 that the Socialist party began to have an independent political existence. In that year it polled 7,440 votes, but did not elect any representatives to the Storthing. In 1903 this was increased to 24,779 and four representatives were elected.

Switzerland.— Switzerland has long been a refuge for exiled revolutionists. It was one of the strongholds of the «International» and Geneva was the seat of several congresses. Nevertheless the party did not take part in elections until in recent years. The following gives the votes at the various elections in which they have participated:

1890	13,500	1893	29,822
1896	36,468		

Russia.—The Russian Socialist movement is of necessity secret. It has also been confused in the past with purely governmental reform move-

Digitized by Google

ments upon the one hand, and conspiratory anarchist organizations upon the other. But in 1898 a Socialist party was organized on Marxian principles with an extremely active secret propaganda, and in spite of the fact that Russian conditions are peculiarly favorable to a conspiratory force movement and the anarchist philosophy, the result here, as everywhere else, of the appearance of a Socialist movement has been the decline of anarchist activity. The initiative for the party comes largely from the students of the Russian universities, although in late years there have been extensive movements of the laborers in industrial districts.

In all of the other minor European nations Socialist organizations are in existence, but in most of them they are rather unimportant, although there are two Socialist representatives in the Servian Legislative Chamber. The Armenian Socialist movement is quite active and, like the Polish, has organizations abroad which help to support the home movement.

Japan.— No sooner had capitalism reached an advanced stage of development in Japan than Socialist activity appeared. This was confined to agitation by lectures and pamphlets until 1901 when a Socialist Democratic party was founded which was at once suppressed by the government. Neverthless there is now one weekly and one monthly journal devoted directly to Socialist propaganda, while several other papers are publishing more or less Socialist material and maintaining a favorable attitude.

South America.— In the South American countries there is more or less Socialist activity in Brazil and the Argentine Republic. In the latter country the movement has reached considerable proportions. It was first founded in 1882 by German immigrants, and in 1890 a national organization was effected and a weekly paper established. By April 1894 there were five Socialist groups, each with its organ, and in December of this year these united in a Central Committee. At the present time, however, the vote is insignificant. The official statistics, which the Socialists claim are incorrect, only record 204 votes as given in 1902; the Socialists claim that this should be 1,000.

Even in China word has recently come of the translation of the works of Marx and Engels into Chinese, and the statement is made by a Chinese reformer that the doctrines of Socialism are making rapid headway in that country.

United States.—The industrial condition of the United States prevented the appearance of any strong Socialist movement until within comparatively recent years. The presence of an ever moving frontier led to a social stratification by geographic stages which was constantly changing and which, therefore, prevented the appearance of any such continuous class struggle as a Socialist philosophy presupposes. The presence of free land and the expanding market meant a large opportunity for individual advancement, both from the ranks of laborers to capitalist and from small capitalist to large capitalist. The Socialist movement is peculiarly a product of the industrial proletariat, and while the population of the United States remained largely rural such a movement could gain no great strength. Again, the existence of chattel slavery throughout the South, prior to the Civil War, created an economic contest between these two forms of industrial organization which overshadowed the still somewhat indistinct contrast between laborers and capitalists. But though these industrial conditions prevented the growth of Socialism in the Eastern sections they gave the greatest encouragement to the growth of a Utopian Socialism, and so it came about that for many years the United States was the experimental ground on which were tested the various theories of European Utopians. These movements are often confounded with latter day Socialism. They really had practically no connection save that both have the idea of collective production. But the collective production of the colony is to be a scheme worked out in our present society, while the collective production of modern Socialism is simply one phase of the coming social stage. William Weitling came to America in 1849 and succeeded in organizing something of a Socialist movement in New York in the years immediately following. His movement, however, was of short duration as was also that of Joseph Weydemeyer, who came shortly after him and who was a personal friend of Marx and Engels. The Civil War wiped out nearly all traces of both of these movements. After the War the influence of the «International» extended to America. This influence was first seen in the National Labor Union in which William H. Sylvis was the most prominent worker and which practically disappeared with his death in 1869. During the next three years numerous sections of the «International» were organized throughout the country, and on the removal of the «International» to this country, some attempt was made to revive it, but its last convention was held in Philadelphia 15 July 1876, and this convention formally dissolved the organization. On 4 July 1874 the Social Democratic Workingmen's Party of North America was organized with a rather indefinite Socialist platform. This grew in strength during the next few years and in 1877 the name was changed to the Socialist Labor Party of North America. Following the extensive labor troubles of 1876 and 1877 this party grew into national prominence and succeeded in electing minor officials in several States. But it was still too indefinite to protect itself from anarchistic influences which crept in and which nearly wrecked the party until finally those influences reached their climax and their end in the Haymarket incident in Chicago. The work of organization had now to be practically all done over again. In September 1887 the Sixth National Convention of the Socialist Labor Party, held at Buffalo, N. Y., took up the work of reorganization. The Socialist elements in the labor movement were still rent with internal feuds, but by 1889 a steady upward growth began to be seen. Meanwhile, certain other movements which have undoubtedly contributed to the strength of Socialism had developed. The Greenback Party and the Henry George movement both contained many of the ideas of Socialism and undoubtedly proved a means by which many were led to adopt the Socialist position. In 1892 the Socialists for the first time nominated a Presidential ticket consisting of Simon Wing of Boston, Mass., and Charles H. Matchett of Brooklyn, N. Y. The following table shows the growth of the Socialist movement during the last few years:

Digitized by Google

1892	21,512	1896	36,275
1893	25,666	1897	55,550
1894	30,120	1898	82,204
1895	34,869		

About this time the Socialist Labor Party changed its attitude toward the trade unions and established the Socialist Trades and Labor Alliance as a rival organization to the existing unions. But this at once led to an animosity both within and without the party and, finally, 10 July 1899, a split starting in Section New York S. L. P. rapidly spread throughout the country until a large majority of the former members of the S. L. P. had left that organization. Meanwhile, another Socialist Party had grown up alongside the S. L. P. Following the A. R. U. strike Eugene V. Debs declared himself a Socialist and organized the Social Democracy. This quickly drew to itself a large number of persons who had objected to the tactics of the S. L. P. Many of these were persons who had been brought to an interest in Socialism through the reading of Bellamy's 'Looking Backward' which had had a tremendous sale during the late '80s. The Social Democracy was first organized on 18 June 1897 at a convention in Chicago. At this time it still retained a demand for colonization and some other features which differentiated it from the international Marxian movement. On 7 June 1898, at the first National Convention of the Social Democracy those who were opposed to these principles bolted the convention and organized the Social Democratic Party of America. This party had a very rapid growth in several States and succeeded in electing in the fall of 1899 two representatives to the Massachusetts State Legislature. After considerable trouble and delay a union was effected between the Social Democratic Party and the bolting majority of the Socialist Labor Party at a convention held in Indianapolis 29 July 1901. During the campaign of 1900 while this union was not completely effected, the two parties supported the same candidates, and Eugene V. Debs and Job Harriman polled a vote of 97,730. Meanwhile the Socialist Labor Party vote had fallen off to 34,191. At the unity convention of Indianapolis the name Socialist Party was chosen for the united party. Since that time this party has been growing at a very rapid rate, and in the National election of 1904, it polled a vote of 406,442, Eugene V. Debs having again been nominated for the office of President, with Benjamin Hanford of New York as the candidate for the Vice-Presidency.

Although the old «International» disappeared in 1876, quite close relations have been continuously kept up between the various Socialist parties, and in 1889 the first of a new series of congresses was held at Paris. This was followed by others as follows: Brussels 1891; Zürich 1893; London 1896; Paris 1900; and the next is to be held at Amsterdam 1904. At the Paris congress an International Socialist Committee was formed, located at Brussels. This organization differs from the old «International» in that it is simply a creature of the great national organizations and a means of carrying out their common ideas, instead of being a great directing and controlling force.

A. M. Simons,
Editor 'International Socialist Review.'

Socialist Party, The. See Socialism.

Societies, Criminal. To find the origin of the idea that has given the world its criminal associations it would be necessary to conduct the search into the realm of fables, for if there has been a time when bands of outlaws have not levied tribute upon poorly protected property, history is silent upon that point. Modern brains only have comprehended the full possibilities of the co-operative idea as applied to the commission of crime, but the earliest applications of the theory, however crude, were probably quite effective. When, in the 11th century, Assan-ben-Sabbah, the «Old Man of the Mountains,» securely protected in his rocky fortress, inspired and directed the horrible crimes of his great band of devoted, hashish-drunken followers, he taught the world a new truth and presented it with a new word, neither of which have been forgotten. The truth was the first clear demonstration of the fact that when associated crime is well organized and carefully directed ordinary methods of protection are powerless to cope with it. The word was «assassin,» the title derived from his own name, which he bestowed upon his band. From that time the criminal association has been too serious a matter to be the inspiration of either song or story. Any attempt to tell the story of the criminal society begins with the Camorra and the Mafia, the two most powerful organizations of the kind the world has ever known. Born and nurtured in Italy, at the dawn of the 19th century, they grew and waxed strong until the one-time clubs of petty criminals had become the gigantic octopus which overawed the entire country and threatened to cause the downfall of the government which had so carelessly permitted such pursuance of a lawless course. Efforts have been made, of late, to cast the shadow of uncertainty upon the primary purpose of these societies. It has been suggested that they were originally organizations of patriots who had banded together to protect against existing tyrannies. A careful study of the history of the time, however, and a close examination of the earliest works of the associations will prove the fallacy of such a theory. Instead of having a noble past to look upon, these organizations have always been what they are to-day, bands of the most heartless criminals, a constant menace to any government and to all laws.

For some time before the Camorra's time, Italy had been writhing in agony beneath the heels of the most corrupt and incompetent body of officials who ever attempted to rule a nation. The one object of the Government was to extract as much money as possible from the people and to give absolutely nothing in return. Taxes which were high were collected relentlessly, but none of the money obtained was expended for the benefit of those who had been taxed. Governmental works were at a standstill, Government officials were unpaid and the immense sums of money which had been extorted from the people were wasted upon royal favorites. Little by little the corruption in high places permeated the whole fabric of society. Justice became a thing unknown. If suit was brought the richest man won, for there was not a judge in the land who was not willing to sell his decision to the highest bidder. Acting upon the same principle the police became the partner of the criminal. As

Digitized by Google

personal wrong and offenses against the laws were never punished, crime became rampant. The poor, robbed by the rich, proceeded to recover from their oppressors by force that which had been taken from them by process of law, and life became a thing of little value.

Then came the French, with their peculiar form of oppressions, which culminated in the theory that a man in prison was a more tractable subject than a man at large. In pursuance of this idea thousands of arrests were made, and the men, unconvicted, were left behind the bars. In a week the poor penal accommodations of the country were taxed to the last limit, but, as the work had only just commenced, castles were seized and turned into prisons. Having arrested their men, however, the French dismissed them from mind. «We will watch them to prevent their escape,» they said, «but we will let the local authorities feed them.» But as the local authorities had too much trouble to raise the indemnities demanded by the conquerors to think of bothering themselves about men who were securely locked behind iron bars, prisoners who were not blessed with independent means had no other option than to starve. As the natural result the strong commenced to prey upon the weak and anyone who had money was robbed without mercy. Among the prisoners there was one in whose brain lodged the seed of socialism. This man was Antonio Giaperelli, and to him belongs the somewhat doubtful honor of having organized the first society of the Camorra. He had noticed that, while new prisoners were always robbed immediately upon their arrival, few of the inmates of the prison profited by these robberies, and he suggested a plan providing for the systematic fleecing of all newcomers, the plunder to be shared equally among all the prisoners. The suggestion met with the approval of the majority and the scheme worked so well that it was not long before the plan was adopted in every prison in Italy. For a time the organization of the Camorra was thus confined within prison walls, but as the members were released it was suggested that a plan that had worked so well under circumstances in which the opportunities for plunder were so meagre might advantageously be extended. Up to the year 1828 the word Camorra had no meaning except to those who had made the acquaintance of the society in some prison, but, during that year the name was written in letters of blood that made all Italy tremble. One day a merchant in the city of Naples was visited by a stranger who asked him to contribute to the support of the «Camorra.» Not knowing the man, and never having heard of such an organization, he naturally refused. The visitor insisted and the merchant was finally compelled to eject him from the shop. Other stores were visited, with a like result, and the strange collector disappeared as he had come, unknown to all. The next day Naples had its sensation. When the wife of the first merchant had attempted to waken her husband she had found him dead in bed, and the stiletto that pierced his heart held to his breast a placard on which it was stated that his death was the result of his refusal to assist in the support of the Camorra. A day or two passed, just time enough to allow the story to become generally known, and then another stranger appeared upon the streets of the city. Store after store was visited and the same request was made, but this time the words, «for the Camorra,» carried such frightful import that many merchants submitted to the blackmail. Some refused, however, and the next morning the murder of another business man warned the people of the uselessness of their attempt to withstand the demands of the order.

From that day the power of the Camorra became practically absolute. From city to city its work was extended until its name was heard with dread in every part of Italy. At regular intervals each storekeeper received a visit from the strange collector and, as death was the penalty of refusal, the money demanded was usually paid without protest. No one was exempt. Wherever goods were sold or trade of any kind was carried on the importunate collector stood ready to receive his share of the profits. He was permitted to go everywhere. He was at the custom house, where he collected his tolls as conscientiously as if he had been a government agent. If money was deposited he stood by the side of the depositor in the banking house. Nothing escaped him, and when the business day closed he paid his visits to the wine shops, the gaming houses and all dens of vice, for the officials of the society were not particular as to the methods used in the making of money so long as they received their share of the spoils.

In this manner was the country terrorized by the operations of a society which had become more powerful than the government. Several half-hearted attempts were made to suppress it, but as its membership was composed of persons from every walk of life the blackmail continued, and at last became open highway robbery. Then it was that the streets of the cities became unsafe either by day or night, and the finding of a dead body on the public highway was of such frequent occurrence as to occasion but little comment. The victim had simply refused to pay his tribute to the Camorra.

It was not until 1877, therefore, that any progress was made in the restoration of order. Then United Italy took the matter in hand, and as this crusade was conducted by honest men who were ready to act with energy and determination, hundreds of the agents of the association were soon arrested, and, as executions and long imprisonments followed, penalties to which the highest as well as the lowest were subjected, it was not long before the dreaded Camorra ceased to be dreaded.

While never as powerful an influence for evil as the Camorra, the Mafia was organized upon similar lines and the fact that it is in existence to-day makes it of greater interest. Like the parent society its purpose was one of murder, robbery and blackmail. Like the parent society it became stronger than the government in its own country, and, as in the case of the Camorra, was only subdued by the exertion of the authorities of the United Italy.

There were two factors that played an important part in the organization of the Mafia. The first was the presence of numerous bands of outlaws organized as a protest against the non-resident land ownership, which had caused so much poverty and misery in that part of the country. There can be no doubt but that these conditions were about as hopeless as present day imagination can picture. The Sicilian peasants had suffered untold miseries at the hands

Digitized by Google

of the heartless agents of the alien landlord, and the ignorance and natural viciousness of the people could suggest but one way out of the difficulty. Assassination and robbery was the remedy. The other factor was the presence of thousands of bravos, soldiers and courtiers who had lost their occupation when Ferdinand granted the demand for a liberal form of government. The abolition of the petty courts, of which there had been so many in the Two Sicilies, threw these men out of employment, and, as they cared neither to work nor starve, they naturally thought of brigandage as the one way out of the difficulty. With that idea in view scores of military clubs were formed and these were the cloaks behind which the members committed their murders and robberies. It was at this time that Mazzini appeared upon the scene. How much he saw of the patriotic side of the question, how much of the criminal, will never be known. We only know that it was his constructive genius that welded the two factors together and that it was to him that we owe the existence of the Mafia. Strange as it may seem the name «Mafia» is meaningless and the word does not appear in any dictionary of the Italian language. In fact, up to the year 1859 the word itself had not been coined. It was only when Mazzini had gone from club to club, and from outlaw band to outlaw band, forming branches of his secret society, that such a title was conceived. Mazzini called his united clubs «Oblonica,» a name which was derived from two Latin words, «obelus,» a spit, and «nico,» I beckon, meaning «I beckon with a spit,» the latter, of course, being the stiletto with which the society was to do such deadly deeds. To say that Mazzini was thoroughly in sympathy with the horrible work to which the society later devoted itself is to go a step beyond the historical, but its purposes, as expressed in the words, «Mazzini autorizza furti incindi avvelenamanti,» meaning, «Mazzini authorizes thefts, arson, poisonings,» gave to the association of criminals its name, the initial letters of the five words being used to form the new word, «Mafia.»

The extent to which the Mafia had expanded was shown in 1876, when the Government was called upon to investigate the abduction of an Englishman named Rose. The sum of $20,000 was demanded, and paid, for his release, and the investigation which followed was so revolting in its details that the result was suppressed by the authorities. It had been shown that the money had been divided among many people of various conditions, from the peasantry to the commander of the post, whose gendarmes were supposed to be pursuing the bandits; the chief of police and detectives of the district, and even the judges of the courts, they having promised immunity in case the abductors should be captured. When the Government of Italy was notified of these facts it took the matter in hand. The corrupt soldiers and officials were sent to another part of the country, being replaced by sturdy and honest regiments from the borders of the Tyrol and the mountains of Switzerland. The new men had no sympathy with crime, no friendship for the criminal. They knew that it was their sole duty to carry out the orders of their superior officers and they performed this duty with a vigor with which even the powerful Mafia could not cope. Whenever or wherever a man was found who could not give a perfectly clear account of himself, or prove that he had no connection with the murderous society, he was shot on the spot. It has been estimated that no less than 5,000 persons met their death at this time, and while the search must have resulted in the killing of many innocent people, the object of the crusade was accomplished, and the Mafia, after its years of prosperity, was driven into obscurity. During this campaign of extermination, however, hundreds of the members of the Mafia made their escape, and many of them came to this country. Rumors to this effect were common at times, but they were not treated seriously until 1890, when the hand of the society was felt in the killing of Chief of Police David C. Hennessey, of New Orleans.

For several years there had existed two rival stevedoring firms in New Orleans, the Provenzanos and the Matrangos, which were in competition for the business of discharging and loading the vessels engaged in the Central American trade. The Provenzanos controlled this business for some time, but their services proving unsatisfactory for some reason, the work was transferred to the rival firm. Then the trouble began. The Provenzanos contended that their services had been dispensed with because the ship-owners were held in terror by the Matrangos, who had threatened them with the Mafia. The Matrangos, however, denied the imputation, and made counter charges in which the Mafia played an important part. In accordance with his duty the chief of police proceeded to look into the matter. Absolutely honest and utterly fearless David Hennessey realized that his discoveries would cost him his life if the society he had unearthed should ever be able to reach him. «They may get me,» he said to a friend, «but if they do they will get me in the back,» a prophecy which was realized on the night of 16 Oct. 1890, when he was shot to death on Girod street. The assassins had been concealed in doorways and, after he had passed, had stepped out from their hiding place to rain upon him a perfect fusillade of bullets. He had threatened to exterminate the Mafia and the Mafia had replied by removing him.

The finale to the story is a unique page in American history. Arrests were made, but conviction seemed impossible, and, at last, the people of the city determined to take the matter into their own hands. That there were stiletto societies in New Orleans was no longer a matter of doubt. They existed and they threatened the security of the city. Their members had killed the chief of police and they had threatened to kill others, including Mayor Shakespeare, who had been bold enough to say:

> We owe it to ourselves to see that this blow is the last. We must teach these people a lesson that they will not forget for all time. No community can exist with murder societies in its midst. The societies or the community itself must perish.

The blow that followed was one from which the Mafia in this country never recovered. It was not used to that treatment, and, since the New Orleans lynchings, it has not raised its head. Police reports show that it still exists in private, however, and there are occasional crimes that may be traced to its door, but this dark cellar existence has little about it to

Digitized by Google

inspire dread, even in the heart of the most timid. That the society has been as thoroughly cowed in Italy is a matter for argument, for in l'affaire Notabartolo, a criminal investigation which is still fresh in the public mind, it was shown conclusively that it was the Mafia which was back of the frauds in the Bank of Sicily, and the Mafia which repaid Sig. Notabartolo's exposure of its crime with death.

From time to time organizations, more or less criminal in purpose, have come into existence in the United States, and it argues well for the character of the people that their life has invariably been of brief duration. As long as the Ku-klux Klan maintained its original purpose it was unmolested, but when its members resorted to the deeds of violence and bloodshed which made its name the synonym for the most brutal lawlessness, both North and South joined hands to wipe out the organization. See Ku-klux Klan.

With 12 murders and a countless number of attempted assassinations to its credit Mollie Maguireism terrorized the coal fields of Pennsylvania for more than 20 years. Unlike the Ku-klux Klan, the Molly Maguires were utterly devoid of noble principle. The first lodge was instituted with criminal purpose and from that day until the last Molly murderer was hanged it remained the most thoroughly organized murder society this country has ever known. For years it was the power which ruled in the coal fields. See Molly Maguires.

From the time of its earliest historical record Asia has been at the mercy of its murder societies and other criminal organizations. The dacoits of India, the Hindu thuggee, the khunhuz of northern Asia, all prove that, from one end of the continent to the other, criminals believe in seeking safety in numbers. The Boxers of China, who are but one of the many criminal wings to the vast secret society system which prevails in that country, have exploited their strength so recently that their horrible work is still fresh in the minds of the civilized races of the world. For absolute corruption, for unalloyed crime, no criminal organization yet known to history can compare to those of China, and some of these associations still flourish, to a certain extent, in every large city in this country under the name of highbinders. One of the most powerful is the Sam Hop, known here as the Chee Kung Tong. The history of the Sam Hop Tong can be traced back more than 250 years. According to tradition it has existed since the establishment of the Chinese nation. Its organization is said to have been due to divine revelation, and it is known that, in its early days, its character was entirely patriotic. It has always been a power in the Celestial world. It helped to overthrow the Tartar dynasty, it was the cause of the Tai-ping rebellion, and of the more recent Ko Lo revolution. Many of the most frightful outrages against the missionaries can also be traced to the Sam Hops. During the two or three centuries of its existence, however, the character of the association has changed. From a patriotic organization, whose only object was to protest against the outrages of a foreign dynasty, the society has become an association of men banded together solely for purposes of murder, robbery and blackmail. On arriving in this country the Sam Hops organized under the name of Chinese Masons, and it was not until 1891 that the police accidentally discovered that the apparently innocent title was a shield to disguise a criminal association. By this time, however, the Chinese quarter of San Francisco had become a hot-bed of crime and highbinder outrages were of frequent occurrence in every large city in the country. Victims of the Sam Hops, unwilling to apply for police protection, organized rival tongs. At first the murders had been committed only by ones or twos, but finally pitched battles were held on the streets, on which occasions scores of lives were taken. These murders, however, were not the only bad feature of highbinder domination. When the members were not killing each other they were levying blackmail upon merchants and wealthy Chinese, compelling them to pay exorbitant prices for the privilege of being unmolested. They also pursued highway robbery with perfect fearlessness and assumed entire control of the traffic in slave girls. In San Francisco, where they were most bold, the police often declared war against them, but with little success until about 1898, when the Chinese business men took the matter in hand, and, at their request, the Chinese officials in this country appealed to the home government for assistance. Then a crusade in earnest was undertaken. The meeting places of the various tongs were found and broken open; record books and other documentary evidence was seized, and hundreds of arrests were made. As the punishment which followed these arrests was applied in the Chinese custom, extending to the relatives of the offenders, those who were still in China being killed and tortured, it was not long before the criminal organizations were driven into comparative obscurity.

The most noxious criminal organizations in the United States have existed in the larger cities, where they have resorted to a higher class of frauds and robberies. Those that have devoted themselves to the open country on the other hand, have been made up of men of a lower criminal stamp, like our own gangs of outlaws, and have been guilty of murder and robbery with violence. Usually these bands have been composed of young men, under the leadership of the most determined man in the company, as in the case of the Younger and James gangs, but there have been instances in which even women have been the leaders of such associations of lawbreakers. Louise Bouviers headed a society of 40 men, and the leader of one of the most heartless companies of Indian dacoits was a woman. While such bands of criminals have usually been recruited from the lower walks of life, instances are not wanting in which men of education and social position have resorted to this method of gaining a livelihood. One society of thieves which terrorized Mayence, in Germany, for several years, was led by an ex-priest, while the «Habits Noirs,» or evening-dress gang, of Paris, was composed of persons of excellent social standing, who had met with financial reverses. In 1837 the authorities of Rome discovered and broke up an organized criminal society, many of the

Digitized by Google

members of which were connected with the noble families of Italy. Among those arrested were Count Dionisi de Traja and the Countess Angellucci de Traja, as well as several members of the Pope's bodyguard, all of whom had been long esteemed as persons of an exemplary character. France has often been at the mercy of such criminal societies, and there is reason to believe that some crime clubs are in existence at the present time.

In 1849 the Thiberts were disbanded, after they had been successful in pursuing all kinds of criminal operations. This association, which numbered more than 800 members, was composed of every variety of criminal, all working, in perfect harmony, under one director. What one branch could not do, another accomplished, and there was no phase of crime which could not be undertaken. The disbandment of the Thiberts, however, was the signal for the organization of other associations along similar lines, and many of these societies were made up of seemingly harmless folk, men and women who lived in apparent respectability, or members of the same family who pursued their careers of crime under the direction of one of their number. Such a man was Hippolyte Villet, the leader of the Lamaire band, whose crime remained unchecked from 1852 to 1855, when the criminals were exposed, and compelled to pay the penalty of their murders and robberies on the gallows.

As has already been stated, Italy has long been the hot-bed of all kinds of conspiracy and brigandage. In 1868, for example, a society was organized in Turin, for the purpose of committing great crimes, and, while the members were thoroughly successful in attaining their object, it was several years before the police were able to lay hands upon any of them. They robbed, they committed burglary, and even murder, but their specialty was the robbing of safes. Bolts, bars and locks seemed absolutely useless when once they turned their attention to them. Sometimes, if the safe was not too large, they took it away bodily to open it at their leisure. This continued success, however, at last resulted in the society's undoing, for when they became so bold that they took to parading the streets at night, drunk, and singing at the top of their voices, it did not take the police long to apprehend them. So perfect was the organization, however, that only 50, in a society of more than 200 members, were arrested. The others escaped, and, it is supposed, came to the United States. Among the latter was the leader of the association, Antonio Bruno.

One of the most recent instances of organized criminal effort was exposed by the police in Paris in 1888. This association, known as the Catusse-Menegant, was one of the greatest of modern bands of criminals, for, while it was under the direction of two men, located in Paris, its lines extended into every part of Europe. Everywhere it had its agents, bands of pickpockets, horse stealers, house breakers, confidence men, and swindlers of every character. In addition to this it operated a banking house in London, through which it was a simple matter to negotiate its stolen stocks and bonds, or to dispose of its silver and gold. With such facilities the operations of the society were naturally enormous, and were only exposed at last through the clever work of the French detectives, assisted by officers from Scotland Yard. The real leader of the Catusse-Menegant was a man named Chambon, who, under the name of Victor Chevalier, lived with his wife in the Rue Poteau. To all appearances his sole business was that of conducting a livery stable. His arrest, and that of his lieutenants, was soon followed by confessions which enabled the police to arrest many other members of the association. They were found in all parts of Europe, and in almost every grade of society, but the evidence against them was so complete that nearly all were convicted and sentenced to more or less lengthy terms of imprisonment. JOHN R. MEADER,
Editor 'American Year Book.'

Societies for Ethical Culture. See ETHICAL MOVEMENT AND ETHICAL SOCIETIES.

Society of American Artists, an association of American artists, comprising in its membership the leading artists of this country. Exhibitions are held annually at 215 West 57th Street, New York. The society awards three prizes each year.

Society of American Authors, founded in New York May 1892, for the purpose of improving the condition of the craft and for assisting authors in the publication of their works. Some of the matters to which the society has called attention are the rates of postage on manuscript, in the United States, as against the postage rates in England and other countries. The American society resembles somewhat the authors' societies in England, Spain, and France. The present membership is approximately 400; the headquarters, 32 Broadway, New York; officers: President, Rastus S. Ransom, New York; vice-presidents, Julia Ward Howe, Andrew Carnegie, Ellen H. Walworth, Lew Wallace, Grace D. Litchfield; treasurer and counsel, Morris P. Ferris; secretary, G. Grosvenor Dame.

Society of the Atonement. See ORDERS, RELIGIOUS.

Society of Camorra. See SOCIETIES, CRIMINAL.

Society of the Divine Saviour. See ORDERS, RELIGIOUS.

Society of the Divine Word. See ORDERS, RELIGIOUS.

Society of the Epiphany. See ORDERS, RELIGIOUS.

Society of the Faithful Companions of Jesus. See ORDERS, RELIGIOUS.

Society Islands (TAHITI), South Pacific Ocean, a French dependency, between the Low Islands and the Friendly Islands. This is the largest group of the Leeward Islands, and consists of the principal island of Tahiti or Otaheite, which is about 32 miles long northwest to southeast, and is divided into two peninsulas by an isthmus about three miles broad; and a great number of comparatively small islands, of which the most deserving of notice are Eimeo or Moörea, Maitea, Tetuaroa, Maiaoiti or Saunders Island, Tahaa or Otaha, Maurua or Mau-

Digitized by Google

piti, Tubai or Motu-Iti, Huaheine, Raiatea or Uliatea, and Bora-Bora. The islands are of rugged surface and conical form, encircled by coral reefs. Sharp peaks usually rise midway in the islands from a low band lining the shores and blooming with groves and orchards. The wooded mountainous slopes are intersected with valleys watered by rapid streams often falling in steep cascades over the rocks. The volcanic formation of these mountainous islands is especially interesting, and the scenery is idyllic, — especially in Eimeo. The coasts contain safe and commodious harbors, the best in Polynesia. The climate, though extremely hot and damp, is healthful. Cotton and sugar, sweet potatoes, bread-fruit and taro are grown, and all kinds of tropical fruits — cocoanuts, vanilla and oranges. The exports include these, together with trepang, cocoanut fibre and mother-of-pearl. The imports — flour, wine, sugar, coffee, soap, timber and live stock, besides manufactured goods. Prior to their contact with Europeans, the people were naïve and ingenuous; thus Capt. Cook found them, and interested English missionaries in their welfare, who were successful in Christianizing them. The islands were discovered by a Spanish navigator in 1606, and were visited by English and French travelers and scientists, and finally ceded their independence to the French, becoming a colony in 1880. The capital and harbor of the group is Peete, on the island of Tahiti. Its chief buildings are a Roman Catholic cathedral, some schools, and an arsenal. The people are of Polynesian extraction and famous as presenting a perfect type of face and form. In 1904 a violent storm brought disaster to the group, depopulating some islands and causing much suffering and destitution. Area, 600 square miles. Pop. about 15,000.

Society of Jesus. See JESUITS.

Society of the Mafia. See SOCIETIES, CRIMINAL.

Society of Mary of Paris. See ORDERS, RELIGIOUS.

Society of Naval Architects and Marine Engineers, an organization founded in 1893 to promote practical and scientific knowledge in the art of shipbuilding and marine engineering, and the allied professions. In furtherance of this object, annual meetings are held for the reading and discussion of appropriate papers and for the interchange of professional ideas, thus making it possible to combine the results of experience and research on the part of shipbuilders, marine engineers, naval officers, yachtsmen, and those skilled in producing the material from which ships are built and equipped. The knowledge thus obtained is circulated by means of the annual publication of the 'Transactions of the Society.'

The society consists of members, associates, juniors, honorary members, and honorary associates. The members' class consists exclusively of naval architects, marine and mechanical engineers, including professors of naval architecture or mechanical engineering in colleges of established reputation, who are not under 25 years of age, and who have been engaged in professional practice in a responsible capacity for at least three years. Associates are persons who by profession, occupation, or scientific attainments, are qualified to discuss the qualities of a ship. Juniors are graduates of technical schools of established reputation, or persons who have had not less than two years' practical experience in marine engine works or shipyards, and who are not less than eighteen years of age, and certify their intention to continue in the profession and become naval architects and marine engineers. Juniors have no voice in the government of the society, but are eligible for transfer to the class of members after fulfilling the necessary conditions. Honorary members and honorary associates whose total number is limited to twenty-five, are persons of acknowledged eminence in their profession upon whom the council may see fit to confer an honorary distinction. The society has a total membership of 900. The head office is at 12 W. 31st Street, New York.

Society for the Promotion of Agricultural Science, a society organized in Boston, Mass., in 1880 for the purpose of promoting the sciences applied in agriculture. It originated as the result of an editorial written by Dr. Sturtevant in 1879, and which appeared in the June number of the 'Scientific Farmer.' Quality rather than quantity was aimed at in the membership, and the number of active members limited at first to 50, was extended in 1892 to 100. The original plan of the founders has been followed throughout of inviting and admitting to membership only those engaged in work of scientific value, and the main objects of the society as specified by Mr. J. W. Beal, the first president, in his inaugural address, delivered in Cincinnati, in 1881, at the second of the annual meetings, have been consistently persevered in. Among them were: To encourage the formation, co-operation and support of agricultural experimental stations; discover and define the best methods for uniform standards in the analyses of soils, fertilizers, and vegetable products; to discover and define the best methods of stamping out parasites and contagious diseases of all domestic animals; to find the best combinations of foods for growing or fattening animals in the various parts of the country; to extend the application of science in dairying; to experiment in fish culture; to investigate the insects which are injurious or beneficial in agriculture, and discover improved remedies for those which are injurious; to make investigations in vegetable physiology, especially with reference to learning how to keep plants in healthy and productive conditions; to advance the subject of improving crops by the selection, cultivation, crossing and hybridizing plants for seed; to encourage improved methods of collecting, arranging and presenting statistics on agriculture, etc. Annual meetings are held at selected centres, and the account of the proceedings, papers, etc., are published. The secretary and treasurer is Mr. F. M. Webster, Urbana, Ill.

Society for Psychical Research. See PSYCHICAL RESEARCH.

Society of Saint John the Evangelist. See ORDERS, RELIGIOUS.

Society of Saint Vincent de Paul, a Roman Catholic charitable organization, founded in May 1833, in Paris, by Frederick Ozanam

Digitized by Google

(q.v.) and seven companions. At their first meeting the object of the society was outlined and expressed in the few words: "Our work shall be for the service of God in the persons of the poor, whom we are to visit at their own dwellings and assist by every means in our power." Frederick Ozanam is considered the founder as he was the first one who suggested the work. The Saint Simonians had taunted the young men who were advocates of Roman Catholic doctrines with being talkers only and not workers. At the very next meeting of Ozanam and his friends, Ozanam suggested an organization which should occupy itself "not with discussions but with good works."

From a membership of eight in a small room in Paris, in 1833, the society has grown to a membership of thousands with local organizations in nearly all parts of the world. The members are men from all stations in life. There are numerous auxiliary societies, composed of women, who assist in the regular work of the Saint Vincent de Paul societies. The instructions given by the Père Bailly at the first meeting created a spirit which is characteristic of the work of the present. He urged the men not to let their work be a "mere doling out of alms," giving only a pittance of money or food, but a medium of moral improvement through personal service. Their education, intelligence, special knowledge of science, and their general knowledge of life are placed at the service of those needing assistance.

The report of the secretary of the Superior Council of New York, for the year 1902, gives the total number of Saint Vincent de Paul conferences throughout the world as nearly 6,000; active members, about 95,000; honorary members, about 100,000. Since this report was issued there has been a great increase in the number of local organizations and in the active membership.

Some of the good works in which the members are engaged are visiting the sick and those in trouble; furnishing food and clothing to the needy, procuring employment for those not engaged in regular work, providing summer country homes for poor city children and homes for the homeless. The members visit the jails, prisons, almshouses, and the poor of the parish. Boys' clubs have been established in many cities, and vigorous efforts are made to distribute good literature. Besides the local meetings, State and national meetings are held annually. In 1904 an international meeting was held in Saint Louis, Mo. At this convention there were delegates from conferences in all parts of the United States, Canada, and other countries. All the councils of the world report annually to the council-general, who has his headquarters in Paris, France.

B. Ellen Burke,
Editor 'The Sunday Companion.'

Society of Tammany, or **Columbian Order.** See Tammany Society.

Socinians, sō-sĭn'ĭ-ạnz. See Religious Sects.

Socinus, sō-sī'nŭs, **Faustus,** Italian theologian; nephew of Lælius Socinus: b. Siena, 1539; d. Poland 1604. Having lost his parents while still young his education was neglected. He was obliged to leave Siena from suspicions of his entertaining heretical notions as early as in his 20th year, and retired to Lyons. On the death of his uncle he came into possession of the manuscripts of the latter, by the study of which he found his former opinions confirmed. He began to publish his views at Florence (where he lived 12 years at the court of the grand duke, Francesco de' Medici) in anonymous writings; and he afterward retired to Basel to avoid the persecutions of the Italian inquisition. His opinions were still more fully developed during a residence in Transylvania, and in Poland he had numerous adherents. The Anti-Trinitarian societies, although they agreed with him in some points of doctrine, yet differed so far in others that they would not receive him into their communion. He formed, however, some small societies of followers there, but suffered persecution in that country, and the confiscation of his property in Italy. His death was hastened by the brutal treatment of a fanatical Cracovian mob.

Socinus, Lælius, Italian theologian: b. Siena, 1525; d. 1562. He was destined for the legal profession, in which his father, Mariano, and several others of his ancestors, had gained distinction; but, moved by the religious discussions which then agitated the greater part of Europe, he abandoned the science of jurisprudence for the study of the Scriptures. In order to prosecute his study thoroughly he mastered the Greek, Hebrew, and Arabic languages. In 1546 he was admitted a member of a secret society at Vicenza, which had been formed for the discussion of religious questions. They soon arrived at the conclusion that the doctrine of the Trinity was untenable, and that many of the dogmas of the Catholic Church were repugnant to reason, which they held to be the only court of appeal in matters of religion. The nature of their deliberations having become known the society was broken up, several of its members were arrested and put to death, and others, among whom was Socinus, left the country.

He visited France, England, and Holland, and resided for some time in Switzerland, Germany, and Poland, where he found many persons who were in sympathy with his views. He is the author of 'Dialogus inter Calvinum et Vaticanum,' 'De Sacramentis,' 'De Resurrectione Corporum,' and several unfinished works, which he bequeathed to his nephew Faustus.

Sociol'ogy (Lat. *socius*, companion, whence *societas*, and Gr. λογος), etymologically "the science of society or association," first coined by Auguste Comte in 1839, and given wide currency by Herbert Spencer since 1860, is still in process of getting a precise definition. It is used in four senses: (1) As a vague general term to include all knowledge and speculation about the associative life of men, and even to describe social facts themselves. This use, especially of the adjective form sociological, for social, or societary, is to be deprecated as slipshod and confusing. (2) Sociology is often made synonymous with social philosophy to describe either a general theory, for example, individualism or socialism, or a special interpretation of historical facts in a philosophy of history. The use of the word has certain validity because of the complexity of social facts and the difficulty of formulating rigid scientific laws

Digitized by Google

(3) Sociology seeks recognition as a science, classifying social facts, and discovering the laws which underlie association as such. To the word sociology in this third sense certain scholars would prefix «pure» and others «theoretical» or «general,» to emphasize one aspect of the strictly scientific ideal. (4) Sociology also describes the scientific treatment of the problems of social organization and welfare. This «practical» sociology is not an isolated science or art, but is organically related to «general» sociology, as with many German economists, «practical» economics is related to «general» economics.

Speculation about social life and institutions may be traced to remote times until it is lost in the uncertain shadows of antiquity.

The Greeks.— Plato analyzed clearly the economy of division of labor, showed a keen insight into the nature and influence of public opinion, described vividly the processes of social degeneration, and pointed out the effect of conscious, concerted action in molding society. He emphasized the possibilities of education in relation to stability and progress and exalted reason as the source of power and permanence. Throughout his discussions, Plato assumes and often asserts law, that is, a uniform and constant behavior of phenomena, as underlying all social facts and relations. Human conduct is conceived and represented not as capricious but as caused. Aristotle displayed an even keener scientific spirit in dealing with social life. His dicta: «Man is naturally (instinctively) a political (social) animal,» and «The state (society) is founded that men may live, but continued that they may live happily,» have an almost modern ring. Aristotle was a realist. He noted the effect of soil and climate on social life; he compared more than one hundred and fifty forms of government and emphasized the principle that human institutions are to be judged not absolutely but in relation to the conditions natural and social under which they grow. He outlined a theory of political revolutions which influences thought to this day. He saw clearly the dominance of law (in the scientific sense) in human affairs.

The Romans added little to social theory save in the formulation of legal principles and especially in the creation of the idea of a «law of nature»— a body of principles common to all peoples and thought of as growing up spontaneously in a state of nature.

Scholasticism.— During the mediæval period all science and philosophy were closely related to theology. Questions bearing upon society were usually treated in conjunction with philosophical and theological science. The social theories then in vogue followed, in the main, the lines laid down by Aristotle, and for the most part were formulated in the scholastic commentaries on Aristotle and in treatises on common law and moral theology. The simplicity of social relations during this period and the want of historical or geographical knowledge of other societies failed to suggest a separate and distinct science upon social problems as understood in modern times.

The Break with Tradition.— But with the Renaissance social philosophy shared in the general division of thought. Sir Thomas More (1478–1537), through the literary device of his 'Utopia,' made notable contributions to the theory of social causation as illustrated by poverty, crime, and punishment, and showed a shrewd knowledge of the force which public opinion exerts upon the members of a group. In a wholly different work, 'The Prince,' Niccolo Macchiavelli (1469–1527) set forth the policies, all based upon the assumption of uniformities in human conduct, which a prince must pursue if he is to gain and maintain sovereignty. More important still was the subtle attack of Thomas Hobbes (1588–1679) on the «divine-right of kings.» In his 'Leviathan,' Hobbes traced the royal power to an original agreement or consent among men that in order to put an end to strife and to preserve peace supreme power should be vested in one man and by him transmitted to his descendants. Hobbes' hypothesis, revolutionary in theory only, was elaborated by John Locke (1632–1704) in his 'Two Treatises of Government,' into a contract theory which based the royal power on the consent of the governed. While these speculations seem at first narrowly political, they really undermined the whole social philosophy of the age.

Rousseau.— This work reached its climax in Rousseau (1712–70) who, in his 'Social Contract,' urged the doctrine of popular sovereignty and struck a telling blow at the theological theory of society. Rousseau was influenced not only by Hobbes and Locke but by the Physiocrats (Quesnay, 1697–1774, Du Pont de Nemours, 1730–1817, *et al.*) a body of French economists who exalted law in social life and attributed its operation to the direct influence not of Divinity but of Nature. Rousseau's tendency to praise primitive simplicity and his cry, «Back to Nature,» are traceable to this Physiocratic school who popularized the idea that beneficent natural forces are at work in the life of peoples and nations.

Vico (1668–1744), a Neapolitan professor of language, literature, and law, was one of the forerunners of sociology in a truer sense than was any one of those yet mentioned. In his 'Principles of a New Science Concerning the Common Nature of Nations,' Vico outlined the natural development of society through the stages of gods, heroes, and men. He insisted that all elements of civilization, that is, language, literature, science, philosophy, law, and government, develop together in constant reciprocal relations. He conceived this development as taking place in recurring although not identical cycles. No one before him had so clearly brought out the conception of causal change extending over so vast a period and displaying law on so grand a scale. Nor did his predecessors describe with anything like the same detail the growth of social institutions.

Montesquieu, Smith, and Malthus.— Montesquieu (1689–1755) in his 'Spirit of Laws' elaborated the truth recognized by Aristotle that human activities and institutions cannot be understood except in connection with natural conditions of contour, soil, and climate. However he may have exaggerated these influences, Montesquieu gave marked impetus to the scientific study of society. To an even greater extent did Adam Smith (1723–90), stimulated by the French Physiocrats, contribute to the discovery and definition of social laws.

Digitized by Google

In his 'Wealth of Nations' he showed the constancy of economic facts and formulated precise and valid generalizations of great value in themselves, as well as suggestive of the causal relations of all social phenomena. Malthus (1766–1834) in his 'Essay on Population' by enunciating a social law in precise mathematical form — that is, that population tends to increase in a geometrical, food supply in an arithmetical ratio — attracted attention, aroused expectation, and although his law broke down so far as its precision went, left a permanent contribution to social science.

Auguste Comte (1798–1857), coiner of the word sociology and sometimes called the "father" of the science, has received somewhat tardy recognition as a man of real genius. His was the first attempt to organize a comprehensive system of social philosophy based upon scientific principles. Marred as it was by error of detail as well as by more serious faults, it was nevertheless in scope and purpose a great achievement. Comte conceived all knowledge as passing through three stages of philosophizing: (1) theological, (2) metaphysical, and (3) positive or scientific. Asserting that each kind of thinking corresponded to a certain type of society Comte affirmed that when theological philosophizing prevailed, society would be military in its form and spirit; with the predominance of metaphysical philosophy it would become legal, and in the positive stage, industrial. Some violence was done to the facts of history and science to make them fit into this scheme, but nevertheless these formulæ are suggestive and the so-called "law of the three stages" often appears in the speech of those who affect to esteem Comte lightly. Comte based his system on a certain conception of human nature, that is, upon psychology. He asserted that man was reluctant to think though reasoning was his greatest need. He drew a parallel between the mental development of the individual and that of the race. He used analogies from biology which were later to become so popular. He conceived of humanity as existing in perfect continuity from age to age, each person sharing and contributing to this common life. This social solidarity he even elevated into an object of worship, founding a religion of humanity whose conception of immortality is found in the persistent influence of personality transmitted through society. Comte adapted from physics the terms static and dynamic. By social statics he indicated the study of a given society or civilization regarded as in equilibrium at a given time, while by social dynamics he sought to describe social change or progress. The key to his system is found in the phrase "Authority must come from agreement, not agreement from authority." He attributed all social ills to mental chaos due to the survival of theological and metaphysical philosophizing. With the final triumph of positive or scientific method all men would have to agree not by external compulsion but by the inevitable logic of exact thought. Thus disagreement would disappear and harmony and solidarity be achieved.

Herbert Spencer (1820–1903).— The growth of biological science early in the 19th century gradually gave precision and definition to theories of development which had been more or less vaguely foreshadowed from the days of the Greeks. Spencer, at first interested in political theory, gradually extended his speculations until he conceived a general principle of evolution, embracing all phenomena from the nebulæ to human institutions. In his 'First Principles' he formulated a law of evolution which he applied to society and to the products of association, that is, language, literature, art, etc. He conceived society as passing from a relatively homogeneous (simple, unspecialized) state to a relatively heterogeneous (complex, differentiated) state. This evolution was further characterized as increasingly definite (the various parts becoming more distinctly marked off) and coherent (interdependent and unified because of the greater specialization and complexity). This law was illustrated with a wealth of material from primitive life, history and contemporary social conditions. In order to popularize his ideas of social science, Spencer published a small book, 'The Study of Sociology,' which together with Bagehot's 'Physics and Politics,' gave great impetus to the scientific study of social facts. In the United States John Fiske in his 'Outlines of Cosmic Philosophy' interpreted and in many cases elaborated and restated with originality of suggestion Spencer's philosophical system with emphasis upon its social side. Recognizing the need of gathering material for a scientific sociology, Spencer set on foot the collection and tabulation of data concerning primitive peoples. The results were published in several large volumes under the title 'Descriptive Sociology.' Spencer has provided in his will for the prosecution of this work. The systematic and full presentation of Spencer's sociological speculations appears in the three volumes of his 'Principles of Sociology,' and the two volumes of his 'Principles of Ethics'— a part of his life-work, the 'Synthetic Philosophy.' The key to Spencer's sociological system is found in the term "the Social Organism," which implies the analogy associated with his name. Spencer's terminology has become so universal that many even of those who attack his theories employ the phrases he originated. Thus integrate, differentiate, homogeneous, heterogeneous, "survival of the fittest," "the struggle for existence," all bear Spencer's stamp.

Contemporary theory reflects certain schools of thought or organizing principles which may be presented under three subdivisions. The biological analogy originally set forth by Spencer, Schäffle, and Lilienfeld has been further elaborated by De Greef, Worms, Novicow, and many others. Spencer asserted in general that societies and animal organisms resemble each other in four respects. Both (1) increase in size as they grow, (2) display increasing specialization of parts which results in (3) higher unity and interdependence; finally (4) in each case the life of the whole extends far beyond that of the parts. On the other hand four differences were insisted upon: societies (1) have no specific forms, (2) are not physically coherent, (3) display an internal mobility of parts (individuals), and (4) in society the whole exists for the parts while in an organism the parts exist for the whole. Spencer himself minimized the first three differences but in his emphasis of the fourth his political individualism found

Digitized by Google

expression. The recent French biological school, headed by Worms, seeks to show that Spencer's four differences on further analysis turn out to be either unessential or additional points of likeness. Spencer in elaborating his analogy asserts a structural correspondence between the social sustaining system (extracting and transforming industry) and the animal alimentary system, between the social distributing system (transportation and commerce) and the individual circulatory system, while the social regulating system (government, and other agencies of social control) is analogous to the central and sympathetic nervous systems. This suggestive figure is carried out by its author into minute detail. Railroad tracks and arteries, telegraph wires and nerve fibres, factories and secreting organs, are displayed in alluring, if often overwhelming parallelisms. While Spencer laid chief stress on structure, Schäffle, on the other hand, pointed out analogies of function. Legislation in society corresponds to reflection in the individual; the judicial function finds its analogy in the æsthetic judgment of the single organism, and executive activity is the analogue of the personal will. Novicow declares that the *élite* or chosen few in society constitute a social brain, while Lilienfeld sees in the conquest of one group by another a process analogous to fertilization in biology. De Greef, who points out a parallel between mental traits of the group and of the individual, is on the border between the biological and psychological schools. The biological analogy has rendered important service in creating an idea of society as a process of growth and adjustment; it has emphasized the thought of interdependence; it has contributed such useful terms as social structure and function, and social disease. The word organism has been adopted by many economists as admirably descriptive of the industrial and commercial system. On the other hand, the analogy has serious limitations. It is only a figure of speech and as such cannot be made a basis for constructive social philosophy or science; it is dangerous to argue from analogy, especially from so intricate an analogy as this of the social organism. With many students the defense and extension of the analogy has seemed more important than the end it should serve, namely, a clearer insight into the nature of society. All that is essential in this analogy is, however, preserved in

The Organic Concept.— German idealistic philosophy has long asserted the spiritual unity of mankind. This was expressed in somewhat vague, even mystical language. With the more precise conceptions of modern science to control and interpret the thought it has taken on a more definite and realistic form. Mackenzie in his 'Introduction to Social Philosophy' has formulated this organic concept which involves: (1) an intrinsic relation between the part and the whole, that is, the part has meaning only in relation to the whole and *vice versa*; (2) there is growth from within; (3) toward an end discoverable within the organism itself. Tested by this standard society is organic, the individual being intrinsically related to his group, the growth of which is from within toward ends discoverable in its own life. Thus the ideas of interdependence, solidarity, unity are preserved, while all the hampering details of the biological analogy are left behind.

Psychological Sociology.— Just as the interest in biology in the first half of the 19th century produced the doctrine of the social organism, so the growth of psychology in the second half has been full of suggestions for social science. It is true that Spencer, Schäffle and their followers recognized and even emphasized the mental nature of social relationships and activities, but their analogies kept them from a detailed study of the social person and his relation to his fellows. They fixed attention on the group as a whole and described its mental aspects in terms of nervous systems and states of individual consciousness. Lazarus and Steinthal were among the first to suggest a group or social psychology. Lewes made many acute observations as to the mental life of associated men. William James began a fascinating study of the social nature of the self — an inquiry which has been pushed forward by Baldwin and Cooley. Tarde is the leader in France of a school which studies group life from the standpoint of psychology. LeBon has also made interesting suggestions as to the mental characteristics of excited animal and human groups. Boris-Sidis has dealt with the same problems. Giddings bases his system on psychology, which also plays a leading part in the work of Ward. Ross has made a searching analysis of the psychological forces by which a social group cozens and coerces its members into orderly conformity. Kidd covers the same field in showing the subordination of the individual to the present and future welfare of the group. The new tendency is away from general analogies to a close study of society as reflected in the conscious life of the social person. This new school questions many of the older conceptions of individuality, freedom, responsibility, originality, etc., and offers new theories of the person and his relation to society.

Sociology as Social Philosophy.— There are several fundamental ways of regarding society and its changes — ways or attitudes which are popularly described as philosophies. They are not mutually exclusive, but are rather exaggerated aspects of one great truth. Of these the chief are:

Evolutionary Philosophy.— This consists in the application to social facts of the general idea of evolution which conceives society as a gradual growth in adjustment to environment, natural and traditional. (See *Spencer* above.)

Individualism.— A product of the 18th and 19th centuries, is largely an inheritance from the economists and moralists, Smith, Ricardo, Bentham, Mill, Bastiat, *et al.* Individualism conceives the person as an almost independent source of initiative, consciously exploiting his fellows, carefully weighing his interests against those of society, feeling free in his choices and accepting responsibility for his acts. This philosophy demands a minimum of interference by the government or other controlling agencies with the freedom of the individual, and sees in enlightened self interest an automatic force which in industry, commerce, morality and intelligence makes on the whole for progress. Spencer in his political and ethical views was a pronounced individualist.

Collectivism, on the other hand, lays all the emphasis on society and on social forces which are regarded as molding the individual

Digitized by Google

to a type. Freedom of the will becomes hardly more than an illusion, and responsibility is diffused throughout society as a whole. The personal unit becomes practically a product of his group which determines his thoughts, feelings, and conduct. Oddly enough Spencer — individualist as he was — gave much aid and comfort to this doctrine. Carlyle, with his hero worship, was vigorously attacked by Spencer, who derided the «great man theory» of history and asserted that law reigned in social phenomena and that capricious, uncaused individuals could not be given a place in this scheme of things.

Materialism, as applied to society, describes the theory that all social institutions are the natural and inevitable product of soil, climate, flora, fauna, and race. Aristotle, Montesquieu, Buckle, Marx, and Loria are associated with this doctrine, which is a special application to society of the general materialistic philosophy.

Idealism in the same way interpretes social life and destiny in terms of divine purpose, or in some other idealistic way. Here belong the philosophers of history. Thus Condorcet attributed social progress to the innate and automatic perfectibility of humanity. Michelet saw in society the progressive realization of human freedom; Lessing the divine education of the race; Bunsen «stages in the progress of human consciousness of God.»

Sociology as Science.— It cannot be said that sociology has yet attained full recognition as a science although in its name much genuine scientific work has been done. Many of the systems put forth by sociologists belong in the class with the philosophies of history mentioned above. Others, however, closely approach a scientific status and warrant inclusion under this head. Science by its very nature demands an adequate basis of facts. The materials available for the sociologist are from three chief sources: (1) The life and institutions of primitive or savage peoples have been studied and interpreted by a large number of ethnologists, anthropologists, and other scholars of whom the most prominent are Maine, Morgan, Tylor, Letourneau, McLennan, Westermarck, Brintón, Waitz, Ploss, Ratzel, Bachofen and Quatrefages. These men have set forth the nature of primitive society in a way which has thrown light upon all the problems of later and more complex civilizations. In these materials and reasoned conclusions the sociologists find an indispensable basis for their work. (2) Again critical historians like Niebuhr, Ranke, Mommsen, Stubbs, Gardiner and their followers have re-examined and re-interpreted historical sources so that a vast store of verified fact and scholarly reasoning is at the service of the student of society. (3) Contemporary social conditions are being studied by hundreds of specialists in economics, political science, demography, penology, etc. Statistics of the highest value are being gathered by government and private agencies. All the facts are available for a scientific sociology.

There are two views as to the proper field and function of sociology as a science. Giddings asserts that it is «the general or fundamental science of society which occupies itself with the elements and first principles of social phenomena,» leaving to the special sciences of ethnology, demography, political economy, political science, etc., detailed investigation. In this view sociology bears the same relation to the social sciences that biology sustains to zoology, botany, anatomy, physiology, etc. Small on the other hand, sees in sociology «a synthesis of all the particular social sciences» and regards sociologists as engaged in the task of «codifying the results of the special social sciences and in organizing these groups of scientific data into a coherent social philosophy.» While these views at first seem radically different, they are not, after all, irreconcilable. Sociology as science must discover the essential principles of association as such; but such principles are discoverable only in the concrete facts analyzed and organized by the special social sciences. Analysis and synthesis are only different aspects of the same process. Ward affirms that «sociology is still in its analytic period. There is even a disposition to condemn all attempts at synthesis.» If there be a distinction in these ideas it is that the «fundamental» view fixes attention on principles, while the «synthetic» theory looks also over the border toward policy and practice

Contemporary Sociologies.—While it is true that there is consensus among sociologists on a few fundamental, general conceptions such as the evolutionary point of view, for example, yet a wide divergence as to problems, methods, and terminology is apparent in their work. It will be useful to outline briefly and, of necessity inadequately, the systems of a few typical scholars:

Lester F. Ward subdivides his study into (1) «genesis,» an account of the unconscious, natural development of society under the influence of the «ontogenetic» forces of exploitation and property, the «phylogenetic» forces, that is, various aspects of the sexual relation, and the «sociogenetic» forces, moral, æsthetic, and intellectual, and (2) «telesis,» an account of the directive effect of human purpose acting on social development. The difference between (1) and (2) is likened by Ward to the difference between the drifting of an ice-berg and the calculated course of an ocean steamer. Ward's main thesis is that human achievement consists essentially in knowledge, and that the preservation, enrichment, and social appropriation, that is, diffusion, of such knowledge are the conditions as they are the agencies of all social progress. Ward's system is based upon a psychology which in many respects is peculiar to him, and he has devised a terminology which is decidedly original and individual. He has elaborated Comte's use of static and dynamic. With Ward knowledge, widely diffused or socialized, is the leading dynamic agent or means of progress.

Gabriel Tarde concerns himself with the fundamental principles of all association, which he declares to be, (1) repetition or imitation; (2) interference or opposition; and (3) adaptation or invention. Social uniformities are produced by widespread imitation of models of language, dress, moral conduct, literature, art, beliefs, etc. But these imitations in the minds of certain individuals conflict, are inconsistent, arouse opposition, upset the equilibrium which would otherwise follow from the uniforming influence of imitation. To meet these problems in his life the individual «invents» a new word, a poem, a play, a business method, a moral principle, a social ideal which forthwith

Digitized by Google

may become a model for a new wave of imitation. Thus society readjusts itself on a higher plane. Such is the rubric of Tarde's system, which contains many brilliant and enlightening observations. His views are set forth in 'Les Lois de l'Imitation,' 'La Logique Sociale,' L'Opposition Universelle,' and 'Social Laws' (trans. by Warren).

Guillaume De Greef classifies social facts in a scale or hierarchy of decreasing generality. Assuming as a base territory and population, De Greef arranges social phenomena in this order: (1) economic; (2) genetic, that is, sexual and family relations; (3) artistic; (4) phenomena of belief; (5) moral; (6) legal; (7) political. Regarding society as a «super-organism,» De Greef employs the language of biology—«functions» and «organs»—to describe the gradual process of social evolution during which the different classes of social facts receive the conscious, purposeful attention of society in the order in which they stand in the hierarchy. De Greef describes admirably «the natural formation of social intelligence,» pointing out the value of group habit and instinct as a source of solidarity and safety, and showing that the progress of civilization is characterized by increasing «social consciousness,» that is, individual consciousness of his group as a whole, of its purposes, and of common plans which demand his co-operation.

J. Mark Baldwin attacks three definite problems: (1) why are men in the same group so similar; (2) why do they differ; and (3) how far is the individual consciously in conflict with his group? The inquiry inevitably leads to the more fundamental questions, what is the individual and what is society? The individual develops by «the dialectic of personal growth» which consists essentially in the imitation and personal appropriation of social materials, ideas, attitudes, activities, etc. But this personal appropriation involves new combinations or inventions which differentiate the individual and prevent the deadly uniformity of a wholly imitative society. The vast majority of social persons having been molded by the group feel no sense of conflict between individual and group interests. Criminals and persons of exceptional abilities are aware of such opposition: the former are suppressed, the latter bring about progress through a «social dialectic,» that is, the appropriation or «generalizing» by society of the «particularizations» of individuals. The person is both a social product and a social factor and the «what» or «matter of social organization consists of thoughts by which is meant all sorts of intellectual states, such as imaginations, knowledges, and informations.»

Franklin H. Giddings has outlined a system based upon the thesis that «Society is not a purely mechanical product of physical evolution. To a great extent it is an intended product of psychological evolution.» Giddings finds in «consciousness of kind» the essential principle of all association, animal and human. At first, human groups are determined by natural conditions and hereditary instincts, but gradually «consciousness of kind» becomes more and more vivid and increasingly effective as a social force. Like-mindedness in the group is little by little «integrated» into higher forms, passing from «sympathetic» to «reciprocal,» to «formal,» and finally to «rational» like-mindedness. The social mind is defined as «that sympathy and concurrent intelligence of the like-minded which results in common purposes and concerted acts.» Giddings follows Spencer in many of his fundamental conceptions to which, however, he adds a close psychological analysis of the individual in his relation to society. Giddings' system is comprehensive, including a survey of social evolution from savagery to civilization; it is described in an individual terminology, and abounds in formulated social laws which are full of suggestion.

Albion W. Small maintains that men's actions must be considered as purposeful, and that all such actions are traceable to choices which manifest six types of interest: (1) health, (2) wealth, (3) sociability, (4) knowledge, (5) beauty, (6) rightness. All these types of demand—however varied may be the specific satisfactions which correspond with them in different times and places—have been and are now operative everywhere. All explanations of the past and plans for the future must be judged with reference to them. In other words, one of the views which society necessarily presents is that of a system of activities each and all somehow related to these six interests. On the basis of this thesis Small outlines a complete system which traces social advancement and the growth of institutions to the unfolding and progressive organization of these fundamental human demands. He lays much stress upon the balanced, proportioned satisfaction of these needs as a criterion of individual and social efficiency.

George Simmel understands the task of sociology to be «description and determination of the historico-psychological origin of these forms in which interactions take place between human beings.» He would therefore abstract the forms of association from all kinds of concrete societies and groups, just as geometry abstracts forms from all concrete objects. The fundamental form of association is «superiority and subordination.» This is discovered to be the underlying principle of all groups from a boys' gang to a nation. Superiority may be exercised by (1) an individual, (2) a group, or (3) by an objective principle higher than individuals. The monarch overthrown, a group of oligarchs takes his place; they in turn yielding to the domination of a still larger group—a majority, the people. However disguised, this principle steadily asserts itself in every society. Moreover, it is a vital condition of group survival. Without some ordered system of «superiority and subordination» the life of a society is impossible. Simmel illustrates his thesis with a wealth of historical material and makes keen observations as to leadership and group reactions upon authority.

Edward A. Ross divides social psychology—«that branch of knowledge which deals with the psychic interplay between man and his environing society»—into (1) «social ascendency» and (2) «individual ascendency.» The former he further subdivides into (a) social influence and (b) social control. It is the latter subject (b) which Ross has so far elaborated. He represents society as, at first instinctively and later with purpose, developing means of controlling individuals in the interest of group order and

Digitized by Google

survival. The basis of control being discovered in sympathy, sociability, and instinctive justice, the means of control are declared to be public opinion, law, belief, social suggestion, religion, typical ideals, ceremony, art, personality, enlightenment, illusion, etc. The organization of these into systems of control is still further described. Ross's study is full of valuable suggestions and has many points of contact with Simmel, Giddings, Baldwin, Tarde, and Kidd.

Gustav Ratzenhofer regards society as an arena of «interests,» which first form individuals, then groups, then wider groups and struggle perpetually for the realization of the dominant interest. Ratzenhofer interprets historical facts and the political situation of modern states in terms of his thesis which is that social life is a process beginning with universal, individualistic struggle, stimulated by crude selfishness, passing into struggle regulated by the state, and thence into struggle that involves increasing admixture of reciprocity, until the process passes out of the struggle phase and becomes co-operative realization of interests with the struggle factor playing a constantly diminishing role.

On further consideration, these brief summaries of individual systems display not so much an actual clash of views as differences of emphasis upon several factors in a complex problem. When variations in terminology have been eliminated, a large and ever-widening field of agreement emerges from the apparent confusion. Thus as to the nature of society all agree that it is (1) a product of physical and psychical forces, (2) working in an evolutionary process in which (3) at first predominantly instinctive activities later yield in some measure to (4) reflective and purposeful policies. This view regards society as (5) organic in the general rather than the specific sense of the term. It is further practically agreed that sociology as a science must deal with the principles which are common to all forms of association, whether these be regarded as in equilibrium or in process of change, that is, it must discover the laws of order and of progress. Within this large field of fact and theory there is room for widely varying research. As a new science dealing with the most complex of all problems sociology can not be expected to reach specific consensus for a long time. This department of knowledge, however, has already vindicated itself by insisting upon a new point of view which begins to affect all the special social sciences. This is conspicuously true of that division of sociology known as social psychology. History, economics, political science, demography, ethnology, all concern themselves with the concrete products of human thought, feeling and conduct. The recent inquiries as to the nature of the social person have shown the inadequacy of the old individualistic psychology as a basis for the special social sciences which are being re-interpreted in terms of social psychology. Thus in this as in every other field of science theory is gradually transformed into practical values.

Social Technology.— But in another and more immediate way is social theory producing practical results. Charles R. Henderson has proposed the term «social technology» to describe the application to social problems of all the knowledge made available by the special social sciences and sociology. Men and women like Graham Taylor, Robert A. Woods, Jane Addams, John Graham Brooks are bringing to bear upon the pressing problems of the day scientific knowledge, tested and transformed into wise and effective action through their experience of life. Sociology is not philanthropy, but as all scientific work must find its ultimate sanction in service to mankind, sociology seeks to increase the resources of «social technology.»

Bibliography.— In addition to the works mentioned the following will be found useful: Fairbanks, ‹Introduction to Sociology›; Henderson, ‹Social Elements›; Stuckenberg, ‹Sociology›; LeBon, ‹The Crowd›; Giddings, ‹The Theory of Sociology›; Morgan, ‹Ancient Society› and ‹Early Law and Custom›; Westermarck, ‹History of Human Marriage.› These references to ethnological literature are simply typical. (See ETHNOLOGY.) Among the periodicals in which social theory is discussed are: ‹The American Journal of Sociology,› Chicago; ‹The Psychological Review,› New York; ‹The International Journal of Ethics,› London and Philadelphia; ‹Mind,› London; ‹Institut de Sociologie,› Brussels; ‹Science Sociale,› Paris; ‹Revue Internationale de Sociologie,› Paris; ‹Zeitschrift für Socialwissenschaft,› Breslau.

GEORGE E. VINCENT,
University of Chicago.

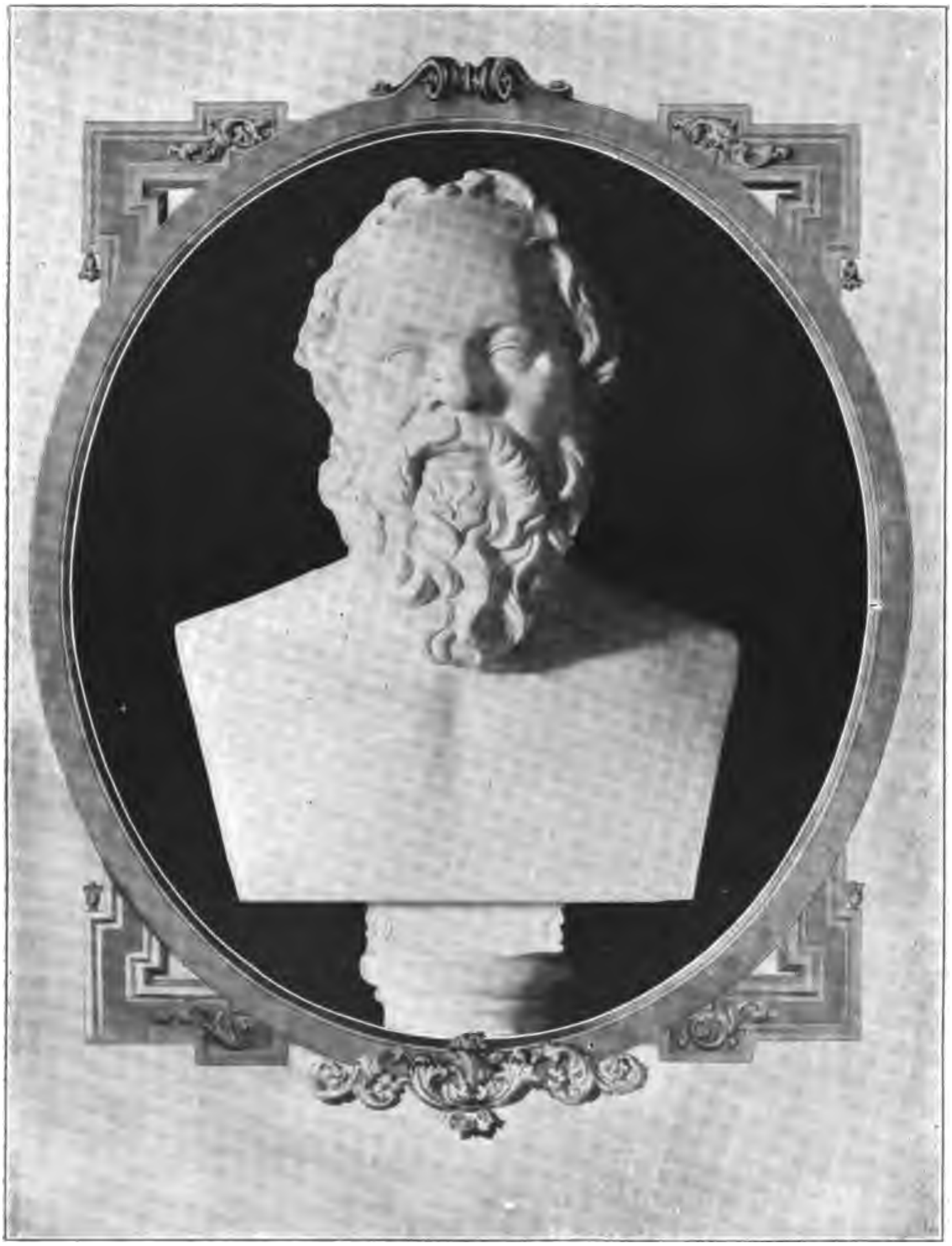
Sock, a low shoe or slipper, worn by the Greeks, and also by the Roman women, who had them highly ornamented. They were likewise worn by comic actors, the buskin, or cothurnus, being used in tragedy; hence sock and buskin are used figuratively as equivalent to comedy and tragedy.

Socorro, sō-kŏr'rō, Colombia, a town in the province of Santander, 150 miles northeast of Bogotá. Its buildings are insignificant; the climate is hot and insalubrious. The manufactures are cotton goods and straw-plaiting. There is considerable trade in sugar, cotton and indigo. Agriculture is the chief occupation. Pop. 20,000.

Socotra, sō-kō'trä, an island in the Indian Ocean, belonging to Great Britain, 150 miles northeast of Cape Guardafui. Its area covers 1,000 square miles. It consists of mountains, covered by forests, rising to heights sometimes of 4,500 feet; plateaus almost destitute of vegetation, fertile valleys, and coast lands. The climate is warm and salubrious. The finest aloes of the world are grown here; also dates. Live-stock raising is an important industry. The people are a mixed race (negro, Arab and Indian), but present two distinct types. In 1876 the English government entered into a treaty with the ruling sultan, declaring a suzerainty, and in 1886 annexed the island. English and German expeditions have investigated its natural features. Tamarida is the principal town. Pop. (est.) 4,000.

Socrates, sŏk'ra-tēz, Greek philosopher: b. Athens, in 469 B.C.; d. 399 B.C. His father, Sophroniscus, was a sculptor, and Socrates himself followed this occupation for a time. His mother, Phænarete, was a mid-wife. In his youth he received the education prescribed by the laws, and also made himself acquainted with geometry and astronomy. That he had listened to Anaxagoras or Archelaus is only reported by untrust-

Digitized by Google



SOCRATES.

Digitized by Google

worthy authorities; Plato accounts for his master's acquaintance with the works of the former by supposing that he had read the work written by that philosopher. According to Xenophon he was familiar with the doctrines of other natural philosophers, although he did not accept them. Plato represents Socrates as saying that, while still very young, he met Parmenides, the most important of the Eleatic philosophers, who was then advanced in years, as the latter was expounding his doctrines. A material influence on his philosophical development was exercised by the Sophists, to whose discourses he occasionally listened, and with whom he frequently entered into conversation. Excepting in connection with his philosophical career, only a few circumstances of his life are known. He served as a hoplite or heavily armed soldier in the campaign of Potidæa (432–429 B.C.), where he excelled his fellow soldiers in the ease with which he endured the hardships of a winter campaign, distinguished himself by his valor, saved the life of his friend Alcibiades, and resigned to that youth the prize of honor which was awarded to his own bravery. He fought at the battle of Delium (424), and according to one account saved the life of Xenophon, while according to another his own retreat was protected by Alcibiades. In 422 he marched with Cleon against Amphipolis. On two memorable occasions he came boldly to the front in political life. After the battle of Arginusæ (406) ten naval officers were publicly arraigned for neglecting the sacred duty of burying the slain in consequence of a violent storm. The clamor for their condemnation rose so high that the court wished to proceed in violation of all legal forms; but Socrates, the presiding judge on that day, refused to put the question. He soon after showed that he could withstand tyrants as well as the populace. He was summoned by the Thirty to proceed with four other persons to Salamis to bring back Leon, an Athenian citizen who had retired thither to escape the cruelty and rapacity of the new government. He alone refused, while the others obeyed the order. He declined taking further share in public affairs, giving as a reason the warnings of an internal voice, a divine Mentor, of which he was wont to speak.

In the writings of the disciples of Socrates he appears almost always as a man advanced in years, such as they themselves had known him. With remarkable physical strength and endurance, he trained himself to coarse fare, scanty clothing, bare feet, and indifference to heat or cold, aiming thus to reduce the number of his wants, as a distant approach to the perfection of the gods, who want nothing. He had a flat nose, thick lips, prominent eyes, bald head, squat figure, and ungainly gait, so that Alcibiades likened him to an uncouthly sculptured Silenus containing within the images of the gods. He brought into thorough subjection his naturally impetuous appetites and irascible temper, and has been called the most illustrious example in history of the moral conscience, and the creator of moral science. But though a sage he was wholly removed from the gloom and constraint of asceticism; he indeed exemplified the finest Athenian social culture, was a witty as well as a serious disputant, and on festive occasions would drink more wine than any other guest without being overcome. Of his wife Xanthippe, all that has passed into history is that she bore him three sons, that she was an arrant shrew, and that he married and endured her for self-discipline. Among the most distinguished of his companions were Plato, Xenophon, Crito, Euclid of Megara, Antisthenes, Aristippus, Phædon, Æschines, Cebes, and Alcibiades. He devoted his life especially to the education of youth, and for the accomplishment of this end he relied on *erōs*, love, which, without excluding its sensuous element, he refined and utilized as an instrument in the conduct of souls and the common development of his thoughts and those of his listeners. Socrates was firmly convinced that he was charged with a special religious mission. He believed he was called by the Deity to strive, by means of his teaching and life, after a revival of moral feeling, and the laying of a scientific foundation for it. For this reason he had been warned against participating in public affairs by the internal divine voice already mentioned. Relying, too, like his countrymen, on divine intimations by dreams and oracles, he believed that his mission had been signified to him by these. Aristophanes, in his comedy of 'The Clouds' (first represented in 423), attributes to Socrates not only traits of character and opinions which really belonged to him, but also Anaxagorean doctrines and sophistical tendencies. The ground of the possibility of this misapprehension, or, if the expression is preferred, of this poetic license, is to be found on the part of Socrates, not only in the fact that he stood, as a philosopher, in a certain antagonism to the general popular consciousness, and that the Anaxagorean theology had not remained without influence on him; but more especially in the fact that, as a philosopher whose reflection was directed to the subjective processes and phenomena, and who made action dependent on such reflection, he moved in the same general sphere with the sophists, only differing from them by the peculiar direction or kind of his philosophizing. On the part of Aristophanes it is to be found in the fact that he, as a poet and not as a philosopher, and (so far as he is in earnest in his representations) as an anti-sophistical moralist and patriotic citizen of the old school, with strong convictions of the immorality and dangerousness of all philosophy, scarcely considered the significance of specific differences among philosophers as worthy of his attention, not to say was unable to appreciate their essential importance.

In 399 B.C. formal accusation was brought against the philosopher in the following terms: «Socrates is guilty of crime, first, for not worshipping the gods the city worships, and for introducing new divinities of his own; next, for corrupting the youth. The penalty due is death.» These are virtually the same charges as were laid against him by Aristophanes more than 20 years earlier. His accusers were Meletus, a young dramatic poet, little known, and personally almost a stranger to Socrates, and who is said to have joined in the accusation because he felt himself injured by Socrates' demonstration of the ignorance of poets respecting their art; Anytus, a rich leather-dealer and influential demagogue, who was displeased with the depreciatory judgment of Socrates respecting the Athenian statesmen and politicians; and Lycon, a public orator, who felt injured by what Socrates said of the orators. The trial took place

Digitized by Google

before a dikastery, or law-court composed of citizen judges, like our juries, but far more numerous; the number present on this occasion has been variously set down at 500, 501, 557, and 567. His bold defense, which appeared to his judges as presumptuousness, is preserved by Plato, under the title of the 'Apology of Socrates.' He dwelt on his mission to convict men of their ignorance for their ultimate benefit; declared himself a public blessing to the Athenians; assuring them if his life was spared he would continue in the same course; and regarded the approach of death with utter indifference. To his judges his philosophical reflections seemed a violation of those ethical and religious foundations of the Athenian state, which the restored democracy were endeavoring to re-establish. The former intimacy of Socrates with Alcibiades, and with the hated tyrant Critias, led to a mistrust of his doctrines and purposes. Yet the condemnation was voted by only a small majority, some read 3 and others 30. But since after his condemnation he would not acknowledge himself guilty, by expressing an opinion as to the punishment he should receive, but declared himself worthy, on the contrary, of being fed at the Prytaneum as a benefactor of the state, and at last only on the persuasion of his friends agreed to a fine of thirty minæ, he was condemned to death by an increase of 80 votes. The execution had to be delayed 30 days, until the return of the sacred ship which had been sent to Delos on the periodical Theoric mission. Every morning his wife and three sons, together with his companions and friends, assembled in his cell, and he conversed with them as he had been wont to do. In his solitary hours he composed a hymn to Apollo, and versified several of the fables of Æsop, his first attempts at poetical composition. His friends formed projects for his escape, and Crito, his old and tried friend, undertook to persuade him to comply with their wishes. He considered it, however, his duty as a citizen to obey the laws, though they were badly administered, and would not consent. Early on the morning of the fatal day his wife and friends met in his cell to spend the last hours with him. Xanthippe was much affected, and showed her grief by loud cries; Socrates made a sign to Crito to have her removed, as he wished to spend his last moments in tranquillity. He then talked with his friends, first about his poem, then concerning suicide, and at last on the immortality of the soul. The manner in which the assembled friends, in the alternation of joyful admiration and profound grief, lauded him as one who, by the divine appointment, was going to a place where it must fare well with him, if with any one; how he departed from them with the one wish, that in their care for their true welfare they would cherish in their memories all his sayings; and how he designated the transition to the life beyond death as the true recovery from a state of impurity and disease, is set down in lively and affecting colors by his great disciple Plato, in the dialogue 'Phædo.' The approach of twilight at length admonished them that the hour had come. He took the hemlock cup, calmly and slowly drank the poison. He then walked up and down the apartment, trying to console his weeping friends. When it became difficult to walk he lay down upon his couch, and before his heart ceased to beat he exclaimed: «My friends, we owe a cock to Æsculapius.» He then covered himself up with his cloak and calmly expired. «Thus died the man,» says Plato in his 'Phædo,' «who of all with whom we are acquainted was in death the noblest, in life the wisest and most just.»

In their accounts of the life of Socrates the two principal authorities, Xenophon and Plato, substantially agree, although the Platonic picture is sketched with the more delicate pencil. As to their reports of his doctrine, it is first of all undoubtedly true that Plato in his 'Dialogues' generally presents his own thoughts through the mouth of Socrates. But in a certain sense his 'Dialogues' can nevertheless serve as authorities for the Socratic teaching, as the groundwork of the Platonic philosophy is contained in the Socratic, and as it is possible, in general, though not in all cases in detail, to discriminate between the Platonic and Socratic elements. Plato was cautious enough not to be led by his love of idealization too far from historic truth; in some of his compositions he remains almost entirely faithful to it, and in others puts those doctrines which Socrates could not have professed into the mouth of other philosophers. Xenophon wrote the 'Memorabilia' and the 'Symposium' not so much in the spirit of a pure historian as in that of an apologist; but his honorable defense of Socrates demands from us entire confidence in his historic fidelity, so far as his intention is concerned. But it must be acknowledged that as much cannot be said of his intellectual qualification for an exact and comprehensive understanding of the Socratic philosophy. Xenophon appears to attribute too unconditionally to Socrates the tendency natural to himself to connect all scientific activity with a practical purpose, and he thus gives too small a place to the dialectic of Socrates as compared with his ethical teachings. The brief statements of Aristotle respecting the philosophical doctrines of Socrates are very valuable, since they are purely historical, and relate to the most important points of his teaching. The previous philosophies consisted of vague speculations on nature as a whole, combining cosmology, astronomy, geography, physics, metaphysics, etc. Socrates had given much attention to these subjects, and arrived at the conclusion that the knowledge he had gained was of little practical value. Astronomy might have a certain value in navigation and in the measurement of time, and so should be learned to some extent by the pilot and the watchman; geometry was useful when confined to land-measuring; arithmetic might be useful in many of the affairs of daily life, and so on; but the speculations of philosophers, from Thales downward, as to the origin of all things out of fire, water, air, etc., he regarded as profitless, nay, as impious even. «Do these inquirers,» he would ask, «think that they already know human affairs well enough that they thus begin to meddle with divine? Do they think they shall be able to raise or calm the winds at pleasure, or do they simply seek to gratify vain curiosity?» The gods managed the operations of nature after their own pleasure, and refused to submit them to invariable laws of sequence, such as could be discovered by human study; the only means of knowledge permitted

Digitized by Google

was sacrifice, prayer, and the consultation of the oracles. Men's strivings after knowledge should be directed to the human relationships as involving men's practical concerns. Self-knowledge, the fulfilment of the requirement of the Delphic Apollo, «Know thyself,» is the condition of practical excellence. External goods do not advance their possessor; to want nothing is divine, to want the least possible brings one nearest to divine perfection. Virtue is capable of being taught, and all virtue is in truth only one; no man is voluntarily wicked, all wickedness simply resulting from ignorance. The good is identical with the beautiful and the useful. Cicero's well-known saying that Socrates called philosophy down from the heavens to earth, and introduced it into the cities and houses of men, compelling men to inquire concerning life and morals and things good and evil, indicates in terms substantially correct the progress of philosophy in Socrates from the cosmology and physics of his predecessors to anthropological ethics. He possessed, however, no complete system of ethical doctrines, but only the living instinct of inquiry, and could therefore naturally arrive at definite ethical theorems only in conversation with others. The fundamental thought in his political doctrine is that authority properly belongs to the intelligent — to him who possesses knowledge. The good ruler must be, as it were, a shepherd to those whom he rules; his business, his «virtue,» is to make them happy. Socrates did not favor the appointment of officers by popular suffrage and by lot. He defends the belief in the existence of gods on teleological grounds, arguing from the structure of organized beings, and founding his reason on the general principle that whatever exists for a use must be the work of intelligence. The Wisdom which is present and rules in all that exists determines all things according to its good pleasure. It is distinguished from the other gods as the ruler and disposer of the universe. The gods, like the human soul, are invisible, but make known their existence unmistakably by their operations.

It is reported that soon after the death of the great philosopher the Athenians regretted their sentence, and that to expiate their crime a brazen statue, the work of Lysippus, was dedicated to his memory. Yet a more general revulsion of opinion in favor of Socrates seems first to have taken place in consequence of the labors of his scholars. That some of the accusers were put to death and others exiled is probably a fable, founded perhaps on the fact that Anytus, banished in all likelihood for political reasons, died in Heraclea, on the Pontus, where in later centuries his tomb was still pointed out. Consult: Phelps, 'Socrates' (1891); Zellner, 'Socrates and His Circle' (1889).

Soda, the normal carbonate of the metal sodium. Its formula is Na_2CO_3. See SODIUM.

Soda Nitre, native sodium nitrate, $NaNO_3$. It is a colorless, deliquescent mineral, crystallizing in the rhombohedral system, but usually massive in beds. It occurs near Lovelock's, Nevada, and near Calico, Cal., and in vast beds in Chile, where it is extensively mined. It is one of the most important fertilizers (q.v.), and is also used in the manufacture of nitre.

Soda Water, a beverage consisting of one, two, or three drams of carbonate of soda dissolved in a pint of water highly impregnated with carbonic acid.

So'dalite, a widely-distributed rock-forming mineral. It is a common constituent of volcanic rocks, especially elæolite-syenites, in which it occurs in isometric crystals or in grains or massive in veins. A sodalite-trachyte abounds in the island of Ischia, near Naples, while fine, white crystals occur in the bombs of Vesuvius. It is best known, however, as a cleavable-massive mineral of rich azure-blue color. It is found thus at Litchfield, Maine, in Ontario and British Columbia, and is well adapted for use as an ornamental stone. Its hardness is 5.5 to 6; specific gravity 2.14 to 2.34; lustre vitreous or greasy; composition, aluminum and sodium orthosilicate with sodium chloride.

Sodalite Group includes sodalite, hauynite, noselite and lazurite, all minerals crystallizing in the isometric system and of unusual interest chemically because they are isomorphous compounds of an orthosilicate with the salt of another acid or with a haloid. Their relations to the Garnet group have been developed by Brögger.

Sodium (from «soda», which word was used in the Middle Ages to designate alkaline substances in general), a metallic element, first prepared by Davy in 1807, by the electrolysis of molten caustic soda, or sodium hydrate. In 1808 Gay-Lussac and Thénard showed that the metal can be prepared by reducing the hydrate with finely divided metallic iron. Brunner, about 1823, obtained metallic sodium by reducing sodium carbonate with carbon; and Deville, in 1855, improved Brunner's process so as to make it commercially practicable for the manufacture of sodium on the large scale. Deville's method, as practised in recent times, consists in distilling a mixture of 30 parts of calcined carbonate of sodium, 13 parts of coal, and 7 parts of lime; the reduction taking place at a temperature of about 2,500° F., the metal being given off in the form of a vapor, which is then passed into a condenser and allowed to liquefy and solidify. As thus obtained, sodium contains numerous impurities, most of which may be removed by straining the melted metal through linen under rock oil, at a temperature of about 212° F. Deville's process of manufacture was used almost exclusively until about 1886, when the well known Castner process came into use. Castner reduced sodium hydrate by a combination of carbon and iron, prepared by coking a mixture of pitch and finely divided iron; the coked mass having approximately the composition Fe_2C, and being commonly known as «carbide of iron,» although it is doubtful if this name is chemically justifiable. The Castner process possesses many practical advantages over that of Deville, and hence it rapidly came into almost universal favor. A considerable quantity of metallic sodium is now prepared by the direct electrolysis of molten sodium hydrate, or sodium chloride (common salt). Sodium possesses powerful reducing properties, and the metal is used in the preparation of silicon, boron, aluminum and other elements whose reduction by means of carbon is either difficult or impossible. Deville, in fact, developed his method of preparation with the object of using the sodium that it yielded in the subsequent preparation of metallic aluminum

Digitized by Google

(q.v.); and for many years the commercial supply of aluminum was practically all prepared by reducing aluminum compounds with metallic sodium. Since the development of the Hall process for the manufacture of aluminum by electrolysis, metallic sodium has lost a considerable part of its former great commercial importance.

Sodium is a silvery-white metal, hard at 0° F., ductile at 32°, wax-like at ordinary temperatures, and pasty at 120°. It melts at 207° F., and boils at about 1,700°. It oxidizes with great facility, and must be kept under benzene, or petroleum, or some other fluid that is devoid of oxygen, or in a neutral atmosphere of hydrogen, coal gas, or some other substance for which it has no affinity. It may be prepared in the form of lustrous, octahedral crystals, white in color but with a rosy sheen. Like potassium, it dissolves in anhydrous liquid ammonia (NH_3), forming a blue solution from which the metal may be again obtained by the evaporation of the solvent. Sodium has a specific gravity of about 0.98, a specific heat (in the solid form) of 0.273, and a coefficient of linear expansion (Fahrenheit scale) of 0.0000395. At the freezing point of water, the specific electrical resistance of sodium is about one-eighteenth of that of mercury.

Chemically, sodium is a monad. It has the chemical symbol Na (from «natron,» the Spanish name for native carbonate of sodium), and its atomic weight is 23.05 if $O = 16$, or 22.88 if $H = 1$. It forms a multitude of compounds, many of which are of great importance in the arts. The chloride of the metal occurs in great abundance in nature, as common salt (see SALT). Its formula is NaCl, and it is extensively used as a source of sodium in the preparation of other compounds of the metal. Sodium nitrate, $NaNO_3$, commonly known as «Chile saltpetre,» occurs native in large quantities in Chile, and as it is much cheaper than the native nitrate of potassium, it is used largely in the manufacture of ordinary nitre; chloride of potassium and nitrate of sodium reacting together to form chloride of sodium and nitrate of potassium. (See NITRE.) Sodium bromide, NaBr, which is extensively used in medicine as a sedative, is prepared by adding bromine to a solution of pure sodium hydrate, NaOH, till the liquid becomes slightly yellow. It is then evaporated to dryness, and strongly heated to decompose the bromate, $NaBrO_3$, which is formed simultaneously with the bromide; after which the residue is re-dissolved and crystallized by evaporation.

Two oxids of sodium are known. Sodium monoxid, Na_2O, may be prepared in several ways, but it is doubtful if it has yet been obtained in a state of absolute purity. It is formed when metallic sodium is oxidized in dry air or dry oxygen, at ordinary temperatures; but it is said that some small trace of moisture must be present, in order for the oxidation to proceed. The monoxid is a grayish solid, having a powerful affinity for water, with which it combines to form sodium hydrate (NaOH), as indicated by the equation $Na_2O + H_2O = 2NaOH$; the combination being attended by the development of a considerable quantity of heat. The monoxid may also be prepared by heating dry sodium hydrate with metallic sodium, its formation in this case being attended by the liberation of hydrogen. Sodium peroxid, Na_2O_2 (also called the «dioxid»), is of considerable commercial importance, owing to its increasing use as a bleaching agent. It is prepared by passing a stream of dry air slowly over melted sodium at a temperature of about 570° F., the sodium being thereby converted into a mixture of the monoxid and peroxid. When all the sodium has been oxidized, the air current is replaced by a stream of dry oxygen gas, which transforms the monoxid that is present into peroxid. Sodium peroxid is soluble in water, but the solution readily decomposes with the formation of sodium hydrate and the liberation of oxygen, as indicated by the equation

$$Na_2O_2 + H_2O = 2NaOH + O.$$

The bleaching effect of the peroxid is due to this liberation of oxygen from the aqueous solution.

Sodium carbonate, Na_2CO_3, commonly known simply as «soda,» or, in an impure form, as «soda ash,» is one of the most important chemical substances known. It was formerly prepared mainly from the ashes of sea-plants, in the same way that carbonate of potassium is obtained from the ashes of land plants; but at the present time it is prepared almost exclusively by chemical means, from common salt. For many years the only method in use for its manufacture was that invented by Leblanc, during the first French revolution, in the latter part of the 18th century. In 1838 the «ammonia» process was patented in England, but although this promised to be superior to the method of Leblanc, certain practical difficulties were encountered which proved to be fatal to its success, until they were overcome by E. Solvay, who erected the first commercially successful «ammonia process» plant near Brussels, in 1861, and for whom the process itself has since been named. A certain proportion of the output of sodium carbonate is also manufactured by electrolysis; but the greater part is manufactured by the Solvay process, though the Leblanc method is still used to a considerable extent.

Leblanc Process.— In the Leblanc method for the manufacture of sodium carbonate there are two successive operations to be performed. The first of these, which is known as the «salt cake» process, has for its object the transformation of chloride of sodium into sulphate of sodium. For this purpose the salt (sodium chloride) is heated with sulphuric acid in large covered iron pans; hydrochloric acid being liberated in the course of the reaction, as indicated by the equation

$$2NaCl + H_2SO_4 = Na_2SO_4 + 2HCl.$$

The hydrochloric acid vapors which are thus generated are passed through a «scrubbing tower,» which contains coke or brick, over which a stream of water is kept running; the hydrochloric acid dissolving in the water, and constituting an important by-product. The crude sodium sulphate, Na_2SO_4, is the «salt-cake» from which this part of the process takes its name. Pure crystallized sodium sulphate (containing ten molecules of water of crystallization) constitutes the familiar substance known as «Glauber's salt,» which is used in medicine as a saline purgative. The salt-cake, as obtained by this first operation, is subsequently treated by the «black ash» process, which is so called on account of the color of the immediate product

Digitized by Google

that it yields. Ten parts of the salt-cake are mixed with ten of limestone (calcium carbonate) and seven and a half of coke, and the mixture is heated in a reverberatory furnace, technically known as a «balling furnace.» The carbon of the coal reduces the crude sodium sulphate to the form of sulphide of sodium, Na_2S, in accordance with the equation

$$Na_2SO_4 + 2C = Na_2S + 2CO_2;$$

while the sulphide, thus produced, is converted into sodium carbonate and calcium sulphide (CaS), by the limestone ($CaCO_3$), in accordance with the equation

$$Na_2S + CaCO_3 = Na_2CO_3 + CaS.$$

In practice these two reactions go on together, and the final mixture of calcium sulphide, sodium carbonate, and such impurities as may be present, is the so-called «black-ash,» or crude soda. Calcium sulphide is insoluble in water in the presence of lime, and hence it is easy to separate the sodium carbonate from the mass by solution and subsequent crystallization. «Crystallized soda,» or «washing crystals,» consists of sodium carbonate crystallized with 10 molecules of water.

The Ammonia (or Solvay) Process.—The ammonia process for the manufacture of sodium carbonate depends upon the fact that when bicarbonate of ammonia, $H(NH_4)CO_3$, is added to a solution of common salt ($NaCl$), bicarbonate of sodium ($HNaCO_3$) and sal ammoniac (NH_4Cl) are formed, as indicated by the equation

$$NaCl + H(NH_4)CO_3 = HNaCO_3 + NH_4Cl.$$

In practice, this operation is carried out by saturating a solution of common salt with ammonia gas (NH_3), and then passing carbon dioxid gas into the solution, under pressure. Bicarbonate of ammonium is formed in the solution, but is immediately broken up with the formation of bicarbonate of sodium, as indicated by the foregoing equation. We may therefore regard the reaction as taking place directly in accordance with the equation

$$NH_3 + CO_2 + NaCl + H_2O = HNaCO_3 + NH_4Cl.$$

The sal ammoniac, being quite soluble, remains in solution; while the bicarbonate of sodium, being relatively insoluble, is obtained in the solid form. The bicarbonate, when dried and strongly heated, gives off carbon dioxid gas and is converted into the normal carbonate, as indicated by the equation

$$2HNaCO_3 = Na_2CO_3 + CO_2 + H_2O;$$

the carbon dixoide thus freed being again used in the first stage of the process. The sal ammoniac that is formed during the process is recovered from solution by evaporation, and the ammonia that it contains is liberated by the action of lime or magnesia. The reaction in the case of magnesia is

$$2NH_4Cl + MgO = MgCl_2 + 2NH_3 + H_2O;$$

the ammonia being used over again, just as the carbon dioxide is. The magnesium chloride, $MgCl_2$, may be thrown away, or it may be resolved, by the action of heat, into magnesia and hydrochloric acid, as indicated by the equation

$$MgCl_2 + H_2O = MgO + 2HCl;$$

the hydrochloric acid so obtained constituting a by-product, just as it does in the Leblanc process.

Sodium carbonate is used in the arts for the greatest variety of purposes. When a stream of carbon dioxid is passed through a saturated solution of the carbonate, sodium bicarbonate (or hydrogen sodium carbonate), $HNaCO_3$, is formed; and, as has already been stated, the bicarbonate may be again transformed into the carbonate by the action of heat. Sodium bicarbonate is used in the manufacture of baking powders, in the preparation of effervescing drinks, in medicine, and for many other purposes.

Sodium hydrate, sodium hydroxide, or «caustic soda,» may be prepared by boiling lime (calcium hydrate) with sodium carbonate, the reaction being

$$Ca(OH)_2 + Na_2CO_3 = CaCO_3 + 2NaOH.$$

The carbonate of calcium that is formed at the same time is practically insoluble, and by allowing it to subside, and evaporating the supernatant liquid to dryness, sodium hydrate is obtained in the form of a white fibrous mass. The hydrate melts at a red heat, deliquesces in the air, and absorbs carbon dioxid gas even from the air, passing then into the carbonate. Sodium hydrate is formed when metallic sodium is thrown upon water, the water being decomposed with the liberation of free hydrogen, according to the equation

$$Na + H_2O = NaOH + H.$$

The heat developed by this reaction is not in general sufficient to ignite the liberated hydrogen. (Compare POTASSIUM.) Sodium hydrate is intensely alkaline, and large quantities of it are used in the manufacture of soap, in the mercerizing of cotton, and for many other purposes.

Of the remaining compounds of sodium, the borate, silicate, phosphate, and hyposulphite may be especially mentioned. Borax, or sodium tetraborate, $Na_2B_4O_7 + 10H_2O$, occurs native, the chief supply of the United States now coming from California. (See BORAX; BORON.). Sodium silicate, Na_2SiO_3, commonly known as «water glass,» is prepared by melting quartz sand with sodium carbonate. It is soluble in water, and is largely used in the manufacture of artificial stone. Three phosphates of sodium are known, phosphoric acid (q.v.) being tribasic. The one which is understood when «sodium phosphate» is mentioned without qualification, is the hydrogen di-sodium phosphate, whose formula is HNa_2PO_4. Hyposulphite (or thiosulphate) of sodium, commonly known as «hypo,» has the formula $Na_2S_2O_3 + 5H_2O$, and is prepared by passing a stream of sulphur dioxid gas through a solution of sodium sulphide and sodium hydrate, and then crystallizing the solution by evaporation. It is extensively used in photography for «fixing» negatives and silver prints; its action depending upon its power of dissolving such parts of the silver salts as have not been reduced by the action of light, or the developer. «Hypo» is also used by paper makers as an antichlor, for neutralizing the last traces of the chlorine that may be left in the pulp, after it has been bleached with «chloride of lime.»

In general, the salts of sodium are closely analogous in all respects to those of potassium, so that for most purposes a salt of either of these metals may be substituted for the corresponding salt of the other one. Salts of sodium that are volatile in the flame of the Bunsen burner communicate to that flame an intense orange-yellow color, and when the light from such a flame is examined through the spectroscope, the color is found to be due to a

Digitized by Google

close pair of lines in the orange-yellow region, which coincide with the «D» lines of the solar spectrum. The light from a flame that is colored by volatile sodium salts is nearly monochromatic, and such flames are therefore used in numerous physical experiments, in which the production of light of a single wave-length is desired.

A. D. Risteen, Ph. D.,
Editorial Staff, 'Encyclopedia Americana.'

Sodom and **Gomorrah,** Palestine, the principal of the five cities, Sodom, Gomorrah, Admah, Zeboïm, and Zoar, described in the book of Genesis as the «cities of the plain» of Jordan. According to Gen. xix. they were overthrown on account of the wickedness of their inhabitants, with the exception of Zoar, which was spared at the supplication of Lot. Modern writers are not agreed as to the site of these cities. They have commonly been placed on the south of the Dead Sea, near the Salt Hill of Usdum; but it appears that this is not in accordance with the Scripture narrative, nor with the other references to these cities in the Bible. The site is supposed to be north of the Dead Sea, and visible on the east from a height between Bethel and Ai. Sodom and Gomorrah are commonly used in the allegorical or denunciatory language of the Scriptures as typical examples of extremely wicked communities. See also Dead Sea.

Sodom, Apple of. See Apple of Sodom.

Sodoma, Il, ēl sō-dō'mä, Italian painter, known also as Giovanni Antonio Bazzi: b. Vercelli 1477; d. Siena 1549. He was noted for his religious and historical works. His best known pictures are the famous frescoes in the Villa Farnesina in Rome. Consult Jansen, 'Life of Sodoma' (1870).

Sofia, sō-fē'ä, or **Sophia,** Bulgaria, capital of the principality, 310 miles by rail northwest of Constantinople, occupies a broad plain of the Balkans. It consists of two distinct sections — the old town and the new town built since 1891. The modern town is suggestive of the French cities: The main streets radiate from the national palace, and are bordered by stucco-covered houses, and fine government buildings, chief of which are: The court of justice, national bank and libraries, War Department, city hall, consulates and theatre; and, in the old town, the Cathedral and Mausoleum of Alexander of Battenberg. There are extensive bazaars and fine baths. On the highest point in the town stand the ruins of an ancient church (and mosque) — Saint Sophia. There are besides several churches, a synagogue, and a monument to Alexander II., of Russia, a university (1888), military and other schools, and a public park. The gypsy quarter lies between the Lion Bridge and the railway station. There is a brisk trade in hides, liquor, corn, and wheat. Sofia stands on the ancient site of Ulpia Serdica, and was occupied by the Bulgarians in 809; in 1382 it was taken by the Turks. In the crusade of 1443 was sacked by the Poles and Hungarians, and in 1878 was captured by the Russians, the Mohammedans fleeing. It has developed rapidly as capital of the Bulgarian principality. Pop. about 71,000; with district, 400,000.

Soft Grass, a grass, described as velvet-grass in the article Grasses in the United States (q.v.).

Soft-shelled Turtles. See Turtle.

Softas, sŏf'taz, pupils who study Mohammedan law and theology in schools attached to the mosques. They are boarded free of charge, the expense being paid from the revenue of the mosques, or from donations made for the purpose. If too poor to provide their own clothing or bedding, it is found for them by the charitable, the support of the softas in their studies being a favorite and pious object of Mussulman generosity. The softas are a most conservative class, and almost fanatical in their adherence to the ancient rules of their religion. They refuse to adopt Western ideas or fashions, and they exert a strong reactionary influence in Turkish affairs. After sufficient study of the Koran, the Sunna, the Arabic language, and other Mohammedan learning, they pass an examination which entitles them to be called Khodjas. The term «softas» is also applied generally to the ulemas, imams, and others connected with the mosques. See Mohammedanism; Sunna; Sunnites.

Soft-shell Baptists. See Baptists.

Sohar, sō'här, Arabia, a seaport on the southeastern coast, on the Gulf of Oman, 230 miles northwest of the capital, Muskat. It is a walled town and its chief buildings are a castle and synagogues. There are iron-foundries and other metal-works, also a considerable weaving industry, and the lands of the vicinity are highly cultivated. As early as the 10th century it was an important centre of trade. In the period extending from the 16th to the 17th century, it was occupied by the Portuguese. Pop. 24,000.

Sohn, zōn, **Karl Ferdinand,** German painter: b. Berlin 10 Dec. 1805; d. Cologne 25 Nov. 1867. He studied under Schadow; was appointed professor in the Academy of Düsseldorf in 1838. Among his most celebrated pictures are 'Rinaldo and Armida' (1827); 'Diana and Actæon' (1833); 'The Judgment of Paris' and 'Romeo and Juliet' (1836); 'Tasso and the Two Leonaras' (1838).

Soil, a term used to designate the superficial portion of the earth's surface composed of broken and disintegrated rock mixed with varying proportions of decayed and decaying animal and vegetable matter (humus). For the entire mantle of unconsolidated material covering the earth's surface and including the soil Merrill proposes the expressive name *regolith,* from ῥῆγος, a blanket, and λίθος, a stone, The soil proper is the upper portion of the regolith. In humid regions as a rule it is easy to trace the gradation from *soil* proper at the surface through *subsoil* to the underlying undecomposed rock. The subsoil is distinguished from the surface soil mainly by a smaller percentage of organic matter and greater compactness, the latter being due to the accumulation of finer particles carried down by percolating water (clay subsoil) or to the formation of *hardpan* resulting from the compacting effect of continued cultivation at a uniform depth or to the cementing action of salts formed in the soil (calcareous and alkali hardpan). Hilgard has shown that on account of the absence of the leaching action of water, the soils of arid regions are often uniform to a great depth, there being little or no distinction between soil and subsoil, although under irrigation and cultiva-

Digitized by Google

tion calcareous and alkali hardpan frequently makes its appearance.

Origin, Formation, and Classification.—Soils have in the main been derived from the solid rock of the earth's crust through the disintegrating (weathering) and transporting action of various agencies, among which are changes of temperature (heat and frost), moving water or ice (glacial action), chemical action of air and water, and the influence of animal and vegetable life (including the action of micro-organisms); and since some of these agencies are continually at work the properties of soils are constantly being more or less modified. Soils are grouped according to the method of their formation into two main classes: (1) *Sedentary soils* formed by the weathering of rock in situ (residual deposits) or by the extensive accumulation of organic matter as in case of marsh or peat soils (cumulose deposits); and (2) *transported soils* composed of materials transported from other localities than that in which the soil is found by water, ice (glaciers), or wind. Under residual soils Merrill includes such as are composed of "those products of rock degeneration which are to-day found occupying the sites of the rock masses from which they were derived, and immediately overlying such portions as have as yet escaped destruction." Such soils occur most extensively in the United States east of the Mississippi River and south of the southern margin of the ice sheets of the Glacial Epoch and are typically exemplified in the usually highly colored brown, red, and yellow ferruginous clay soils of the Southern Appalachian region. The cumulose deposits are typically illustrated in the United States in the Dismal Swamp lands or the muck soil of Florida.

The more important examples of transported soils are *alluvial soils*, familiarly typified in the river bottom lands and deltas like those of the Nile and Mississippi; *æolian soils* composed of materials transported by the wind and typified by the sand dunes of seacoast regions and the characteristic loess of China and other countries; and *glacial drift soils* due to glacial action. Such drift soils cover a large portion of the Northeastern and North Central United States and are composed of the debris of disintegrated rocks of various kinds brought down from the north during the glacial period. Besides these main types of soils there are several others of more or less importance in the United States, including the soils composed of fine *volcanic ash* found in considerable areas in Kansas, Nebraska, Colorado, Montana, and other western States; *adobe*, a stiff clayey soil distributed in circumscribed areas over a large portion of the arid region of the United States; *gumbo soil*, a compact fine silty soil; and a so-called loess supposed to be of alluvial origin. In practice soils are as a rule described simply as gravelly, sandy, loamy, clayey, calcareous, humous or peaty, etc., according to the fineness of the soil particles and the proportions of sand, clay, lime, and humus. They are also distinguished as light or heavy, but as so used these terms do not refer to the actual weight of the soil, but rather to the ease with which it is cultivated. Thus sandy soils, which are termed "light" in an agricultural sense, are actually heavier than clay soils, which are considered "heavy" from an agricultural standpoint.

There are almost innumerable gradations of soil types as regards chemical and physical characteristics, so that a satisfactory classification on this basis is very difficult. The Bureau of Soils of the United States Department of Agriculture, therefore, maps and classifies the typical soils of the areas it surveys on the basis of the differences in agricultural value as determined by field observations on "the character of the soil and its relation to crops and vegetation" supplemented, however, by physical and chemical examinations. Considering the soil mainly as a medium into which plants send their roots and from which they draw a part of their food, it is evident that its agricultural value will depend largely upon the character of the original rocks from which the soil was derived, the degree of fineness to which the material has been reduced, the amount and character of the organic admixture, as well as upon the treatment to which the soil has been subjected and the changes it undergoes under cultivation. The fertility of a soil is therefore determined not only by the store of plant food which it contains, but depends to a large extent upon the chemical, physical, and biological processes by which this plant food is rendered available to plants. The soil is not only a storehouse of plant food, but a workshop or laboratory in which this food is being constantly prepared for the use of plants, and it is the object of cultivation to promote the processes by which this is brought about. Chemical, physical, and biological properties and processes are so intimately associated in soil that it is not always possible to clearly distinguish between them. For convenience of discussion, however, it is desirable to consider them separately.

Chemical Composition and Properties of Soils.— Plants derive their ash or mineral constituents and nitrogen from the soil, and in order that a soil may produce plants it must contain these constituents in proper proportion and in assimilable condition. Nitrogen is one of the largest and most important constituents of plants, and while the ash constituents are taken up in comparatively small amounts by plants they are none the less essential to their growth. The more important soil-derived elements of plant food include chlorin, sulphur, phosphorus, silicon, potassium, sodium, calcium, magnesium, and iron. Since the rocks from which soils are derived contain more or less of all the mineral elements it is not likely that any soil will be entirely lacking in any of the necessary maineral elements. Their proportion and availability for assimilation by the plant may, however, vary so widely as to cause wide differences in productiveness. The constituents of soils may be divided into three classes: (1) Active, that is, soluble in water or the root secretions of plants and hence readily available; (2) latent, that is, not soluble in water or root secretions, and hence not readily available, but becoming so in time through natural agencies, by the application of fertilizers or soil amendments such as lime, marl, etc., or as a result of tillage; and (3) mechanical. The last is by far the largest class, constituting usually from 90 to 95 per cent of the entire mass of the soil, and chemical analysis shows it to be as a rule mainly silica or sand. Hilgard gives the average composition of soils of arid and humid regions as deter-

Digitized by Google

mined by ordinary methods of chemical analysis (treatment with strong acids) as follows:

AVERAGE COMPOSITION OF SOILS OF HUMID AND ARID REGIONS.

Constituents	Humid region Average of 466 soils		Arid region Average of 313 soils	
	Per cent		Per cent	
Insoluble matter	84.031	87.687	70.565	76.135
Soluble silica	4.212		7.266	
Potash		.216		.729
Soda		.091		.264
Lime		.108		1.362
Magnesia		.225		1.411
Manganese oxid		.133		.059
Iron oxid		3.131		5.752
Alumina		4.296		7.888
Phosphoric acid		.113		.117
Sulphuric acid		.052		.041
Carbonic acid		.....		1.316
Humus		2.700		.750
Nitrogen in humus		5.450		15.870
Nitrogen in soils		.122		.101

It will be observed that the proportions of actual fertilizing constituents — nitrogen, phosphoric acid, potash, lime, etc. — are relatively small. When, however, the amounts per acre are taken into consideration they assume greater importance. Assuming that a cubic foot of soil weighs 80 pounds, an acre to a depth of 1 foot would weigh 3,484,800 pounds or 1,742 tons. On this basis the principal fertilizing constituents in one acre of soil having the average composition given above to a depth of 1 foot would be as follows:

cent citric acid as proposed by Dyer), which it is assumed approximates the solvent action of the root secretions of plants and so represents the power of plants to utilize the soil constituents. Schloesing, however, among others, has called attention to the importance of studying the availability of plant food in the soil by means of water extracts, and the Bureau of Soils of the United States Department of Agriculture has adopted a method based upon the solubility of the soil constituents in water as follows: One hundred grams of soil are shaken up vigorously for 3 minutes with 500 cubic centimetres of distilled water, allowed to stand 20 minutes, and the supernatant liquid decanted, filtered, under pressure, through unglazed porcelain (Chamberlain-Pasteur filter), and analyzed. Applying this method, however, to a large number of productive and unproductive soils of the United States, Whitney and Cameron reach the conclusion that "practically all cultivable soils contain naturally a nutrient solution which varies within comparatively narrow limits with regard either to composition or concentration and which is usually sufficient for plant growth" and that therefore there is no obvious relation between chemical composition of soil and yield of crops.

The availability of the soil constituents depends largely upon the extent to which disintegration has proceeded and the amount of leaching to which the soil has been subjected. Thus the soils of arid regions in which disintegration has been going on uninterruptedly for ages with no leaching the soluble salts are always found in large and often in excessive

PRINCIPAL FERTILIZING CONSTITUENTS IN ONE ACRE OF HUMID AND ARID SOILS TO A DEPTH OF ONE FOOT.

	Nitrogen	Potash	Phosphoric Acid	Lime	Humus
	Pounds	Pounds	Pounds	Pounds	Pounds
Humid soils	4,251.46	7,527.17	3,937.82	3,763.58	94,089.6
Arid soils	3,519.65	25,404.19	4,077.22	47,462.98	26,136.0

These are amounts far in excess of what can be removed in many years by the most exhaustive system of cropping. The productiveness of a soil as determined by chemical composition depends, however, as already stated, not so much upon the total amounts of the constituents present as upon their availability for the uses of plants. Ordinary chemical analysis may show the presence of large amounts of all of the necessary fertilizing constituents and still the soil may be unproductive if these constituents are not in a form in which they may be readily appropriated by the plant. Chemical analysis is capable of showing the presence, absence, or marked deficiency of any necessary constituent or the presence of harmful substances, but it has not yet reached such a stage of perfection that it can show with absolute certainty the amount of available plant food which a soil contains, although agricultural chemists are making considerable progress in devising methods for this purpose.

The method most commonly used for determining the availability of plant food in soils involves the treatment of the soil with a weak solution of some organic acid (usually 1 per

amounts, as for example, in the so-called *alkali soils* which are simply soils containing an excess of soluble salts accumulated at or near the surface, and which when this excess is removed or dispersed are among the most fertile known.

Chemical analysis shows soils to be very variable in composition, and since the processes by which soils are formed and plant food rendered available are continually going on, frequent examinations are necessary if accurate knowledge of the chemical properties of a soil at any given time or the amounts of plant food becoming available during the period of growth of a plant is to be had. While, as already intimated, chemical analysis must not be taken as an absolute guide to the fertilizer deficiencies and requirements of soils, certain general deductions have been drawn from soil analyses which may be of practical value if applied with discrimination. For example, German authorities classify soils on the basis of their chemical analysis as follows: Soils containing less than 0.05 per cent of either nitrogen or phosphoric acid are considered as poor, those containing from 0.05 to 0.10 per cent moderately rich, 0.10 per cent average or normal, from 0.10 to 0.15

Digitized by Google

per cent good, and above 0.15 per cent rich; soils containing less than 0.05 per cent of potash are classified as poor, from 0.05 to 0.15 per cent moderately rich, from 0.15 to 0.25 per cent average or normal, and over 0.25 per cent rich; loam soils containing less than 0.10 per cent of lime are classified as poor, from 0.10 to 0.25 per cent moderately rich, from 0.25 to 0.50 per cent average or normal, from 0.5 to 1 per cent good, and over 1 per cent rich; sandy soils containing less than 0.05 per cent of lime are classified as poor, from 0.05 to 0.10 per cent moderately rich, from 0.10 to 0.20 per cent average or normal. Over 0.20 per cent of lime is not often found in sandy soils.

The minimum percentages of the different mineral elements in the soils of the United States, which according to Hilgard, chemical analysis has found to be necessary to the thrifty growth of general crops, may be summarized as follows: Potash is capable of great variation without material effect. In heavy clay uplands it may range from 0.08 to 0.05 per cent, in lighter loams from 0.45 to 0.3 per cent, in sandy loams below 0.3 per cent, and in sandy loams of great depth may fall below 0.1 with good productiveness and durability. The proportion of lime in high sandy soils averages about 0.1 per cent, clay loam 0.25 per cent, heavy clay soils 0.3 per cent, and the proportion may rise with advantage to 1 or 2 per cent. Magnesia is seldom deficient*. Iron is always present in abundance. Phosphoric acid depends for its effectiveness largely on the proportion of lime present; 0.1 per cent is usually sufficient for productiveness when accompanied by a fair supply of lime. It rarely runs higher than 0.3 per cent. Humus usually ranges in the loam uplands of the cotton States from 0.7 to 0.8 per cent; in the poorer sandy soils from 0.4 to 0.5 per cent; in the black calcareous prairie soils from 1.2 to 2.8 per cent. «In California (and in the arid region generally) the humus percentages, as might be foreseen, average somewhat lower; lowest in light loam soils of the high mesas of Southern California, where 0.3 per cent, and even less, has been found; yet these soils produce well at first, when irrigated. Percentages of 0.45 to 0.60 of humus are common in good upland soils that are neither very calcareous nor highly ferruginous. The prairie or black adobe soils usually range from 1.2 to 1.8 per cent — a very few as high as 3. On the whole, the highly ferruginous soils are remarkable for large amounts of humus.» Humus is not only important as a source of supply of nitrogen, but also of other plant food constituents — potash, phosphoric acid, lime, etc. According to Snyder, the proportion of these constituents combined with humus to form humates represents to a large extent the amounts available in the soil. An important property of soils, which is partly chemical and partly physical, is their absorptive power for fertilizing constituents which prevents these constituents from being lost in the drainage or dissipated in other ways before the plant can utilize them. Of the more important fertilizing constituents soils apparently have the least retentive power for nitrogen (in the form of nitrates) and the greatest for phosphoric acid. Soils apparently hold lime less tenaciously than potash since it has been shown that when potassium chlorid is added to a soil the potash is retained by the soil and lime of the soil passes into the drainage in combination with the chlorin.

Physical Properties and Processes.— The physical properties of soils which are of special importance are color, weight, fineness of division or texture, arrangement of particles or structure, adhesiveness and relations to heat, gases, water, and dissolved solids. The physical properties of soils are due largely to their natural characteristics and can at best be controlled to only a limited extent by man, and therefore the practice of selecting soils with special reference to the suitability of their physical properties to the crop to be grown is a wise one. Nevertheless good tilth with good water conditions, aeration, and temperature, as well as an adequate supply of plant food, which are so essential to productiveness, may be modified and improved to a marked extent by proper management, culture, and fertilizing, and with the improved physical conditions the chemical processes of the soil come effectively into play.

The physical properties of soils depend largely upon the relative proportions of stones, gravel, sand, clay, lime, and organic matter present. Sandy soils are as a rule light colored, dry, warm, of low adhesive power, have little absorptive capacity for moisture and fertilizing matter, and are generally poor. Clayey soils are more adhesive and have a stronger absorptive power for water and fertilizing matter. They are as a rule wetter, cooler, and more difficult to work than sandy soils, but are naturally more fertile. Soils containing a considerable amount of humus are dark colored and light in weight and have a strong absorptive power. Most humus soils are fertile if not too wet. Lime improves the structure of both sandy and clayey soils, hastens the decay of organic matter, corrects acidity, and promotes nitrification.

The color of soils is determined in most cases by the proportions of organic matter and oxid of iron they contain and is of little importance except that it probably affects in some degree the temperature of the soil (see below).

Soils vary widely in weight as aready intimated. Hall gives the following figures:

WEIGHTS PER CUBIC FOOT AND PER ACRE OF DIFFERENT KINDS OF SOIL.

	Weight per cubic foot	Pounds per acre to depth of 9 inches
Heavy clay	66.4	2,150,000
Sandy clay	80.0	2,600,000
Light loam	76.4	2,480,000
Sandy loam	76.7	2,490,000
Sandy peat	49.0	1,580,000
Light sand	79.2	2,560,000

Texture and Structure of Soils.— The productiveness of a soil depends to a considerable extent upon its texture (fineness of particles) and structure (arrangement of particles). These properties determine largely the circulation of water and gases, the solution and retention of plant food, and the growth of roots of plants. Good texture and structure thus enable a poor soil to produce better crops than a more fertile

*According to Loew magnesium salts unaccompanied by a certain proportion of lime exert a toxic effect on plant growth.

Digitized by Google

soil of which the texture and structure are not so good. One of the main objects of tillage is to promote better soil texture and structure. These properties are effected to a considerable extent by various fertilizers. For instance, lime has the power of flocculating the soil particles and thus renders soils more porous, while sodium nitrate and many other substances have a tendency to puddle the soil, that is, to keep the particles separate and thus prevent the open floccular structure. Soils containing large amounts of clay and other fine particles are most injured by puddling and hence most benefited by flocculating by means of lime.

Relation of Soils to Heat.— The temperature of the surface soil is subject to the same changes as that of the air, but these changes occur more slowly. The variations decrease as the depth increases until they finally disappear. There are several modifying influences affecting the temperature of the soil. The first of these is color. A dark colored soil is usually warmer than a light colored soil. A soil containing much sand or gravel is as a rule warmer than one containing much clay or humus as already intimated. Soils exposed so as to receive a large amount of the direct rays of the sun are warmer than those not having such exposure. Probably the most important factor determining the temperature of a soil is its water content. A wet soil is cold. Evaporation is a cooling process, and the heat necessary to carry it on is drawn from the soil, thus lowering its temperature.

Relation of Soils to Water.— The development of plants is impossible without a sufficient supply of water in the soil at all periods of growth. Water is not only an important constituent of plant tissue, but it is of the greatest importance as a solvent and carrier of food in the soil and in the plant. A comparatively small part of that taken into the plant is used to build tissue, the larger part passing out through the leaves by transpiration, which is, however, essential to the healthy growth of the plant. It is estimated that for each pound of dry matter produced in the crop from 250 to 500 pounds of water is drawn from the soil. All soils are capable of absorbing and retaining moisture, but the extent to which they do so varies widely, a fact which is of great importance in determining the mutual adaptability of crops and soils. As a rule the capacity of soils to hold water is proportional to the size of the soil particles, the finer the particles the larger the total surface area of the particles and the greater the capacity for water, although this is not invariably true. King has computed the pore space and surface area of the particles of different kinds of soils as follows:

PORE SPACE AND SURFACE AREA OF PARTICLES IN DIFFERENT KINDS OF SOIL.

KIND OF SOIL	Pore space	Area of surface per cubic foot of soil
	Per cent	Sq. ft.
Finest clay soil	52.9	173,700
Fine clay soil	48.0	110,500
Loamy clay soil	49.2	70,500
Loam	44.1	46,500
Sandy loam	38.8	36,880
Sandy soil	32.5	11,000

Coarse sand allows water to run through freely, retaining relatively little, while fine clay absorbs and retains a large amount. The proportion of organic matter is also an important factor in determining the water-holding capacity of soils, the larger the proportion of organic matter the greater capacity of the soil for holding water. Healthy root development is not possible in a soil saturated with moisture. The most favorable amount of water for plant growth is stated to be from 40 to 75 per cent of that which the soil is capable of holding when completely saturated. Another important factor to be taken into consideration is that soils vary in the readiness with which they give up water to growing plants when the amount becomes limited. Crops can utilize a larger proportion of the water in open, coarse-grained sandy soils than of that in compact fine-grained clay soils. In other words, plants will suffer from drought on compact clay soils containing a proportion of moisture which would be entirely sufficient for their needs on sandy soils. Thus, while sandy soils have a much smaller total storage capacity for water than clay soils, the available water is more nearly equal in the two cases than would at first be supposed. Sachs found that tobacco plants began to wilt when the water content of sandy soil was reduced to 1.5 per cent, of clay soils to 8 per cent, and of sand and humus to 12.3 per cent.

Water exists in soils in three different states, which may be termed hydrostatic, capillary, and hygroscopic. Hydrostatic water is that which fills the soil spaces and would drain away if given opportunity. Its upper surface stands at a certain level, which is known as the *water table.* Capillary water is that which is capable of rising in the soil or of moving from a more moist to a less moist part of the soil under the influence of surface tension without regard to the force of gravity. Hygroscopic water is that which closely surrounds the soil particles, but is not affected by gravity and does not move through the soil under the influence of surface tension. Capillary water is often drawn from the hydrostatic supply and is the most important from the standpoint of plant growth. Hygroscopic water is not of great value to vegetation. Heinrich found that plants begin to wilt before the water content of soils is reduced to the hygroscopic limit.

Soil water when present in sufficient amount is constantly in motion. In case of rainfall, irrigation, or the melting of snows, the moisture sinks into the soil, carrying along with it oxygen, carbonic acid, nitric acid, ammonia, etc., and rendering plant food available, a part of which may be lost in the drainage if the water supply is excessive. This downward movement or percolation of water due to gravity is most rapid in soils of small retentive power, that is, coarse-grained open soils. Agencies like lime, which flocculate the soil particles and loosen the soil, promote percolation, and those like alkali salts, which tend to compact the soil and puddle its particles, retard it. When the supply of water ceases evaporation commences, and the soil water begins to rise by capillarity, carrying along with it dissolved plant food which accumulates in the surface soil within easy reach of the roots of plants. A harmful accumulation of soluble salts (alkali), however, is thus some-

Digitized by Google

times brought about in regions of deficient or irregular rainfall.

The capillary properties of soils are of great importance since they determine largely the available water supply of soils. Different soils vary widely as regards the amount of capillary water they retain. Coarse sand sometimes retains as little as 15 per cent, while heavy clay loam and soils containing a large amount of humus often retain as much as 50 to 60 per cent. Ordinary loams retain about 40 per cent. As King has pointed out, however, the amount of capillary water actually found in soils in the field are as a rule smaller than the theoretical amounts that the soils are capable of holding, and are controlled to a large extent by the depth of the water table, which is constantly fluctuating. The capillary movement of water has been observed to extend to a depth of seven feet, but declines as the depth of the water table increases. As a rule the amount of capillary water in the soil decreases from the water table upward toward the surface. In the finer soils the moisture as a rule rises more slowly, but to a greater height than in the coarser. The force, surface tension, which causes water to rise in a soil also produces a lateral movement, but this is much slower than the other. All movements of water become more rapid as the soil approaches saturation.

Under ordinary conditions moisture is constantly escaping from the soil by evaporation. Evaporation may be reduced by tillage and mulching which interfere with the capillary rise of moisture in the soil, and by the use of windbreaks which lessen the drying effect of winds. The belief is common that the moisture conditions of soils may be materially modified by the use of fertilizers, more especially by the application of common salt, but careful observations and experiments on this point have failed to show any decided effect in increasing the water content of soils by ordinary applications of salt and similar substances.

Biological Action in the Soil.— A large and very important part of the changes which go on in soils is due to biological processes, that is, to the actions of living organisms including the roots of plants, earthworms, and other living agencies, but especially the micro-organisms, generally grouped under the term bacteria. These play an important part in fixing the free nitrogen of the air in the soil for the use of plants, in converting the organic nitrogen of soils into the readily available nitrates by the process of nitrification, or in causing a loss of the soil nitrogen by denitrification. They are also active agents in the disintegration of rocks and the formation of soils; and in the formation of acids from organic matter in the soil, thus rendering the application of lime or other neutralizing agents necessary. It is the object of good soil management to so control the conditions of moisture, aeration, temperatures, etc., that the beneficial biological processes are promoted and the harmful restrained.

Exhaustion, Improvement, and Reclamation of Soils.— Soils are said to be exhausted when they no longer yield profitable crops, but strictly speaking there is no such thing as absolute exhaustion of soils. Whitney and Cameron maintain «that practically all soils contain sufficient plant food for good crop yields (and) that this supply will be indefinitely maintained.» The commonly accepted view, however, is that decline in productiveness is due both to a loss of fertilizing constituents from the soil and to deterioration in its physical condition.

Among the principal causes of loss of soil fertility are (1) the growth and removal of crops without restoring the equivalent of the fertilizing constituents they contain; (2) surface washing, and (3) leaching. All crops contain a considerable amount of fertilizing matter drawn from the soil, and it is held that if these crops are grown continuously and sold away from the farm without return of an equivalent in manure or fertilizers the soil will in time show a decline in fertility. The harmful effects of surface washing is a matter of common observation and needs no further discussion here. The loss of fertility in the drainage water is generally supposed to be very considerable, and under certain circumstances this is true, depending upon the character of the soil and the treatment to which it is subjected and the fertilizers applied. «Leachy» soils part very quickly with the fertilizing materials applied to them unless covered with crops which utilize the fertilizers promptly, and as already shown, certain fertilizers have a tendency to set some of the soil constituents free and throw them into the drainage water.

While these are all possible sources of loss, it is probably safe to say that under ordinary conditions the chances of loss of any considerable amount of lime, potash, or phosphoric acid in the drainage water of soils are very small. As regards the loss of the important and expensive fertilizing constituent, nitrogen, however, the case is very different. The soil appears to have very little affinity for the form of this element most commonly used as a fertilizer, namely, nitrate of soda, and if it is not quickly taken up by the crop it is likely to pass into the drainage and be lost. Moreover, other less soluble forms of nitrogen are under favorable conditions rapidly converted into nitrates by the process of nitrification and so may also be lost in the drainage. Dehérain has reported experiments in which the loss of nitric nitrogen in the drainage from a bare soil in the course of a year was nearly 180 pounds per acre, while the loss from a soil which was kept covered by a crop was almost insignificant, although fully as large an amount of nitrates was formed in the latter case as in the former. Unproductiveness due to physical condition may be corrected by a variety of means, including drainage, irrigation, tillage, and by a judicious system of cropping and the proper use of fertilizers.

There are large areas of swamp, marsh, or muck soils which prove highly productive when reclaimed. In reclaiming such soils the first essential is thorough drainage. This is not only necessary for the purpose of removing the excess of water, but to allow the free circulation of air in the soil, in order that the poisonous compounds which are usually present may be oxidized and thus rendered harmless, and that the processes of decomposition and nitrification so necessary to render plant food available in this class of soil, may be set up. Paring and burning to a depth of 12 to 16 inches as practised in Ireland and in European countries, and the lib-

Digitized by Google

eral use of manures and fertilizers, may often be necessary in addition to drainage, since such soils are as a rule deficient in phosphoric acid and potash, and although composed almost entirely of organic matter they are often deficient in available nitrogen. Lime and the bulky manures exert a beneficial effect on the texture of the soils, rendering them more porous, and thus improving drainage and increasing aeration and nitrification. Liberal applications of wood ashes also improve the texture of the soil, correct acidity, and favor nitrification, and at the same time furnish potash and phosphoric acid. An application of a mixture of kainit or muriate of potash with some cheap phosphate, such as fine-ground Florida phosphate, may be substituted for the ashes. The untreated mineral phosphates have been used with advantage on muck soils, the decomposing organic matter assisting in rendering the phosphoric acid available. There are large areas of sandy lands in different parts of the United States which are extremely deficient in plant food, but which prove very valuable for a variety of purposes, but especially for early crops, when they are properly managed. One of the first requirements of such soils is an increase of humus to improve their water-holding capacity. The most effective means which has been found for increasing the humus supply in such soils is the growing and turning under of green crops, preferably leguminous plants, which are nitrogen collectors. Moderate liming has also been found beneficial in many cases.

Methods of Investigation.— Three principal methods are employed in studying the characteristics and requirements of soils, namely, (1) mechanical and chemical analysis; (2) experiments in pots or boxes, and (3) field experiments. The nature of the methods pursued in the chemical investigation of soils has already been indicated. The object of mechanical analysis is to separate the soil into particles of different degrees of fineness so that a basis may be secured for judging of the physical properties of the soil. Mechanical analysis as ordinarily practised separates a soil into what is termed skeleton (consisting of coarse particles like gravel and coarse sand larger than 0.5 millimetre in size) and fine earth, which includes all particles passing a sieve with meshes 0.5 millimetre in diameter. The fine earth is further separated into some six different grades, ranging from medium sand with particles 0.25 to 0.5 millimetre in diameter, through fine sand, silt, to clay, the particles of which are less than 0.005 millimetre in diameter. The methods of mechanical analysis which have been employed are of three classes: (1) hydraulic (Hilgard, Schöne, Nöbel); (2) sedimentation (Osborne, Schloesing, Knop), and (3) centrifugal. The methods which have been most commonly used in the United States are modifications either of Osborne's beaker (sedimentation) method or Hilgard's elutriator (hydraulic) method. The physical examination of a soil also involves determinations of water-holding capacity, rate of percolation, capillary rise, hygroscopicity, adhesive power, etc., for all of which ingenious methods have been devised.

The soils of the United States have been studied to a considerable extent by the agricultural experiment stations, but while the work of the stations on soils has been quite varied and extensive it has not been systematic. The need for systematic and concerted study of soils has, however, been met by the organization and development of the work of the Bureau of Soils of the United States Department of Agriculture, which undertakes the survey, mapping, and study of soils on a scale never before attempted in this country. In the inauguration of this work «it was recognized that differences of commercial value could be seen in the field from the character of the soil and from its relation to crops and vegetation; that it was quite possible to map these soil areas independently of the geology of the area or the exact chemical or physical character of the soil; that the proper course was to construct maps in the field, showing the area and distribution of the soil types; to explain as fully as possible from geological considerations the origin of the soil, and to have the soil chemist and physicist study the differences in the soil types. The fact is recognized that these chemical and physical properties of the soils are so complex and difficult that it may take many years to explain them through laboratory investigation; but, pending this complete investigation, the maps themselves will be of the utmost value to the agriculturists in indicating the areas over which certain soil conditions are found to prevail. It is clearly recognized that the climate has much to do with the relation of soils to crops, and for this reason a brief statement of the climatic conditions is always given in the reports. It is also recognized that certain economic conditions, frequently local, have a controlling influence upon the relative crop values of a soil. The chief among these are the questions of ease and cost of transportation, the market conditions, and the conditions of labor and similar social conditions. These matters are brought out as clearly and as strongly as possible in the reports of the work.» Extensive laboratory investigations supplemental to the field operations are being conducted with a view to determining the chemical and physical properties of soils, improving methods, and working out a more clearly defined classification.

In Germany elaborate soil surveys with reference to physical and chemical properties and productive and taxable value of the land are being made under government auspices by the «Laboratorium für Bodenkunde» at Berlin. A systematic chemical survey of the soils of Belgium is being made under the direction of the Gembloux Station. In France soil surveys have been undertaken by several of the departments, the soils being mapped with reference to their crop adaptations and fertilizer requirements. In Russia soil surveys have been successfully prosecuted in several of the governments, and Japan has made considerable progress in work of this character.

Bibliography.— Risler, 'Géologie agricole' (Paris 1884–1895); McConnell, 'Elements of Agricultural Geology' (1902); Marr, 'Agricultural Geology' (1903); Shaler, 'The Origin and Formation of Soils' (Twelfth An. Rpt. U. S. Geol. Survey 1890–1, I., pp. 213–245); Stockbridge, 'Rocks and Soils' (1895); Merrill, 'Rocks, Rock-weathering, and Soils' (1897); Fream, 'Soils and Their Properties' (1895); King, 'The Soil' (1898); Hall, 'The Soil' (1903); Storer, 'Agriculture' (1897); Roberts, 'The Fertility of the Land' (1897); Dehérain,

Digitized by Google

'Chimie agricole' (Paris 1903); Warington, 'Physical Properties of Soils' (1900); Dyer, Investigations on the Rothamsted Soils (Bulletin 106, Office of Experiment Stations, U. S. Department of Agriculture, 1902); United States Weather Bureau Bulletins 3, 4, 5, Publications of the Bureau of Soils of the United States Department of Agriculture. W. H. BEAL,
United States Department of Agriculture.

Soil, Physical Properties of. See SOIL.

Soil Survey. See SOIL.

Soiling, the practice of feeding green crops fresh from the field to farm stock, either as an amendment to pasture, or as a substitute for it. It has attained its highest development on the dairy farm, and is worthy of extension to other branches of stock-husbandry. During the 18th century it was a common practice in Flanders and was discussed by the agricultural writers and experimenters of that day; and in 1820 Josiah Quincy directed American attention to the subject in a series of essays printed in 'The Massachusetts Agricultural Journal,' which were later issued as a book entitled 'The Soiling of Cattle.' Arthur Young, with other writers, pointed out the following advantages from soiling: The saving of land and fencing; the economizing of food and greater comfort and better condition of the cattle; greater production of milk, and the acquirement of manure. Henry, of Wisconsin, has shown that one acre of soiling crop equals about two and a half acres of good blue-grass pasture for feeding dairy cows. It is no longer debatable whether or not soiling is profitable under most conditions. Abundant testimony is forthcoming to show its advantages and the gain to be derived from even partial soiling as an amendment to pasture. The question whether soiling should be substituted entirely for grazing must be decided by the circumstances involved. On rocky hill-pastures of low value, grazing cannot be discarded, while on high-priced, easily-tilled land, near markets, and where labor can be obtained, the soiling system has a place.

NEW JERSEY SCHEME.

Species of crop	Time of seeding	Approximate time of feeding
Winter Rye	September	May 1–10
Winter Wheat	September	May 10–20
Crimson Clover	September	May 20–June 1
Oats and Peas	April 1	June 1–10
Oats and Peas	April 10	June 10–20
Mixed grasses	September	June 20–30
Oats and Peas	May 10	July 1–10
Cowpeas	May 20	July 10–20
Corn	June 1	July 20–Aug. 1
Japanese Millet	June 20	Aug. 1–10
Cowpeas	June 10	Aug. 10–20
Corn	June 20	Aug. 20–Sept. 1
Soy Beans	July 10	Sept. 1–10
Japanese Millet	July 20	Sept. 10–20
Corn	July 1	Sept. 20–Oct. 10
Barley and Peas	August 10	Oct. 10–20
Barley and Peas	August 20	Oct. 20–30

In the soiling system it is essential to have a succession of crops, and in selecting these due consideration must be given to the number of animals to be fed, the time when the crops will be needed, and the number of days required for their development. For partial soiling in the summer, alfalfa and two plantings of corn, with sowings of peas and oats at intervals, will furnish abundant feed. Where complete soiling is pursued, some such succession of crops must be grown as outlined by Phelps for Connecticut, Voorhees for New Jersey, and Lindsey for Massachusetts.

For the Southern and Western States this scheme could be modified. A good rotation of crops should be arranged so that two or three crops may be grown on the same land during one year. Alfalfa should be grown wherever possible, as it can be cut from May to September, and is relished by all stock, while the expenditure for labor is at a minimum. Corn gives a large yield at comparatively little cost. Two serious factors in the complete soiling system are that the labor bill is high where land is continuously under tillage, and that the crop producing power of the soil is speedily reduced unless it is maintained by abundant manuring or fertilizing.

Consult: Phelps, 'Bulletins 8, 9,' Storrs Agr. Exp. Sta., Connecticut; Lindsey, 'Bulletin 39,' Hatch Agr. Exp. Sta., Massachusetts; Henry, 'Report for 1885,' Agr. Exp. Sta. of Wisconsin; Armsby, 'Report for 1889,' Agr. Exp. Sta. of Pennsylvania; Wilson, 'Bulletin 15,' Agr. Exp. Sta. of Iowa; Voorhees, 'Fertilizers' (New York 1900); Henry, 'Feeds and Feeding' (Madison, Wis., 1900); Jordan, 'Feeding of Animals' (New York 1901); Peer, 'Soiling, Soiling Crops, and Ensilage' (Ithaca, N. Y., 1903). SAMUEL FRASER,
Instructor in Agronomy Cornell University.

Soissons, swä-sôṅ, France, a city in the department of Aisne, 51 miles northeast of Paris on the Aisne River. It is an episcopal see, and the old cathedral (12th century) contains a library, with a valuable collection of manuscripts. Here stands the venerable abbey of St. Jean des Vignes (1076), where Thomas à Becket sought refuge when exiled; the Romanesque church, Saint Peter (12th century); Notre Dame and Saint Léger. The chief secular buildings are a museum of antiquities and a public library, with 30,000 volumes; besides a college and two seminaries, and a hospital. There are interesting Roman antiquities, including the ruins of a large amphitheatre, coins, mosaics, sculptures, and vases. Near the suburb of Saint Vaast lies the village of Saint Médard, the site of a revered abbey with seven churches, a famous place of pilgrimage. Soissons has oil-mills, stocking factories, and tanneries, and a large trade in grain, flour, and beans. The town has been the scene of many important historical events, the battle ground of fierce armies, and has often changed hands.

Sojourner Truth, American abolitionist: b. Ulster County, N. Y., about 1775; d. Battle Creek, Mich., 26 Nov. 1883. She was born a slave, and received the name of Isabella Hardenberg. That of Sojourner Truth she claimed to have been revealed to her by God as designating her mission in the world. By the act of the New York Legislature of 1827 abolishing slavery in that State, she became free, and, having gone to New York, was brought to the attention of Susan B. Anthony and other well-known abolitionists and reformers. Encouraged by them, she began her career as a public lecturer, at first upon the slave question and, after the emancipation of her people, as an advocate of women's rights and in the cause of temperance. For many years she endeavored to secure from the government of the United States a grant of

Digitized by Google

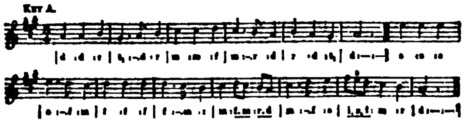
public lands for the establishment of a negro colony.

Sokoto, sō-kō'tō, Nigeria, Central Africa, (1) Capital of the government of the same name, situated on a long ridge, 18 miles east of Warnu, which forms a joint capital. It is surrounded by a wall and is well built in Moorish style. There are important manufactures of muslin, shoes, iron-work, etc., and there is an active trade. Pop. 80,000. (2) A semi-dependent native government, bounded by Sudan on the north, the River Benue on the south, and on the east and west by the native kingdoms of Bornu and Gandu, respectively. Its area is about 200,000 square miles. The general relief is flat, but in the province of Adamawa rises to an altitude of 10,000 feet. It is well watered, and there are large deposits of excellent iron ore. The ruling race is the Fulah. Their subjects — the Haussa and various negro tribes — form the population. In 1885, the sultan of Sokoto put his kingdom under the protectorate of Great Britain and granted to the Royal Niger Company the monopoly of trade. Pop. 12,000,000.

Sol-fa, Tonic Sol-fa, or **Movable Doh, System,** a modern scientific method of classifying, explaining, and teaching the facts of music, of especial value in the acquisition of the art of sight-singing. The system proceeds on the principle of giving the chief prominence to the fact that there is in reality but one scale in music, which is raised or lowered according to the pitch of the key. The seven notes of the diatonic scale are represented by the solfeggio (q.v.) syllables, or rather modifications of them — Doh, Ray, Me, Fah, Soh, Lah, Te; Doh standing for the keynote in whatever key the music is written. In the early exercises the pupils are accustomed to a scale or diagram, called the Modulator, representing pictorially the exact intervals of a key, with the semitones in their proper places. In written music only the initial letters of the solfeggio syllables are used — d, r, m, f, s, l, t; the higher octaves of a given note being distinguished by a ^{1} above, as d^1, r^1; and the lower by a $_1$ or $_2$ below, m_1, m_2. The name of the key is prefixed to a tune as its signature, as "Key A," "Key B flat" — the keynote being, in all the major keys, Doh. To indicate rhythm a perpendicular line | precedes the stronger or louder accent, a colon: the softer accent, and, where necessary, a shorter perpendicular line | the accent of medium force. A note immediately following an accent mark is supposed to occupy the time from that accent to the next. A horizontal line indicates the continuance of the previous note through another pulse or beat. A dot divides a pulse into equal subdivisions. A dot after a mark of continuance indicates that the previous note is to be continued through half that pulse. A comma indicates that the note preceding it fills a quarter of the time from one accent to the next; a dot and comma together three quarters. An inverted comma ' is used to denote that the note preceding it fills one third of the time from one accent to the next. An unfilled space indicates a rest or pause of the voice. A line below two or more notes signifies that they are to be sung to the same syllable. The following example of the tonic sol-fa shown alongside of the ordinary notation, illustrates most of the features named:

f^1
m^1
r^1
d^1
te
ta lah
se soh
fe fah
me
ray
doh
t_1
l_1
s_1
f_1
m_1

Modulator.



My Country 'Tis of Thee.

In modulating into a new key the note through which the transition is taken is indicated by a combination of the syllabic name which it has in the old key with that which it has in the new — me lah, for example, being conjoined into m'lah, and in writing this note (termed a bridge note) the initial letter of its syllable, as a member of the old key, is placed in small size before and above the initial of the syllable of the new, as ^{m}l ^{d}s. In the case however, of an accidental, where the transition is but momentary, a sharpened note changes its syllabic vowel into e, and a flattened note into aw, spelled a, as fah, fe, soh, se, te, ta. In the minor mode lah is the keynote; the sharp sixth is called bay, and the sharp seventh se. The signature of the key of A minor is "Key C"; lah is A.

The method of teaching is of equal importance with the notation itself. For a full explanation of this system, consult Curwen, 'Course of Lessons and Exercises in Tonic Sol-fa.' Its advocates maintain that it possesses advantages over the common system in the facility of its acquisition; the distinctness with which it indicates the keynote and the position of the semitones; the cheapness with which it is printed; and the manner in which, they say, it explains the proper mental effects of notes in harmony and key-relationship, and employs them in teaching. It has, however, been objected to by others, from its withdrawal of the direct indication of both absolute and relative pitch to the eye which exists in the common notation, from its limited applicability to instrumental music, and from its acquirement not being, like that of the ordinary notation, an introduction to the world of musical literature. It presents, however, no barrier, but rather a road to the acquisition of the older notation; and its widespread use and the testimony of the general body of practical teachers are eloquent arguments in its favor.

In the history of music various attempts have been made to introduce a musical notation in which the staff with its lines and spaces is dispensed with. Jean Jacques Rousseau suggested, but afterward discarded, a notation where the notes of the scale were indicated by the Arabic numerals — a principle which is the chief feature of the Chevé system,

Digitized by Google

largely used in France, the time-names of which have been adopted by the Tonic Sol-fa system. The latter system, similar to Rousseau's in its leading features, has been promoted chiefly by the Rev. John Curwen (q.v.), who obtained his main principles about 1840 from Miss Glover, a teacher at Norwich. It has been brought into almost general use in the singing-schools of Great Britain and her colonies, but its introduction into the United States has not met with any conspicuous success. Of the children in English primary schools who can sing from notes 80 per cent learn on this system, which has replaced the "Fixed Do" system of Hullah, its rival in earlier days. The London Tonic Sol-fa College, founded in 1869, with its system of examinations, carries on a vast amount of useful work.

So'lan Goose, the common gannet (q.v.).

Solanaceæ, the nightshade family, an order of plants containing about 1,500 species arranged in 70 genera, mostly herbs and shrubs widely distributed in warm climates, and especially in tropical America. They are usually malodorous and are characterized by alternate, lobed, or undivided leaves, monopetalous flowers of various colors and sizes arranged in various ways — fascicles, cymes, solitary, and followed by two-, to many-celled fruits with numerous seeds. The order is of wide economic importance, since it contains several leading food-plants such as the potato, tomato, tobacco, cayenne, red or garden pepper, and various weeds and garden plants, as the petunia, jimson-weed, mandrake, and others. The typical and foremost genus is *Solanum*, of which more than 500 species have been described, mostly natives of tropical America. They are smooth, downy or spiny plants with white or blue axillary flowers borne singly, in cymes, or in fascicles, followed by roundish two-celled berries containing many kidney-shaped seeds. The principal species is *S. tuberosum*, the common potato (q.v.), in which, as in many other members, is found an alkaloid, solanin, reputed to produce unpleasant physiological effects when the plants are eaten to excess. *S. melongena*, the egg-plant, is another leading food-species. It was formerly regarded as noxious; on which account Girarde (1597) entreats his countrymen to eschew it. *S. aviculare* or *laciniatum* is the kangaroo apple of Australia and New Zealand, where its fruits are eaten. *S. muricantum*, the pepino, melon-pear or melon-shrub, yields an edible fruit suggesting an acid-flavored egg-plant fruit. It is grown to a small extent in the United States. The fruits of several East Indian species are eaten either alone or in curries, etc. Two European species, *S. nigrum*, the common nightshade, and *S. dulcamara*, the bitter-sweet, are common weeds in the United States. The horse nettle (*S. carolinense*) and *S. rostratum* are native, spiny weeds. Several species were formerly used in medicine and still are in the Orient. *S. saponaceum* yields berries which are used as a substitute for soap. Several species, particularly *S. jasminoides*, the potato vine, and *S. seaforthianum*, are popular greenhouse plants of easy culture.

Sol'anine ($C_{21}H_{35}NO_7$), a substance obtained from the *Solanum mammosum* of the Antilles. It is also found in the berries of the *S. nigrum*, as well as in the leaves and stems of bittersweet (*S. dulcamara*). To obtain it ammonia is poured into the filtered juice of the berries, when a grayish matter falls down, which is collected on a filter, washed, and treated with boiling alcohol. The solanine precipitates from this by evaporation. It is an opaque, white, somewhat pearly-looking powder; without smell; very bitter; fusible below 100° C.; decomposable at a higher temperature; insoluble in water, ether, oil of olives, and essence of turpentine; but very soluble in hot alcohol, from which it crystallizes in slender, silky needles. It combines with acids, forming salts. It is eminently emetic, and even in small doses is poisonous.

Solar Corona, in astronomy, the portion of the aureola observed during total eclipses of the sun, which lies outside the region of colored prominences. The region of colored prominences is called the chromosphere. See SUN.

Solar Cycle. See CHRONOLOGY.

Solar Engine. See SOLAR MOTOR.

Solar Microscope, an instrument by means of which a magnified image of a small transparent object is projected on a screen, the light employed being sunlight. The solar microscope is really a magic lantern, in which the microscopic object is affixed to a clear plate, and the light employed bright sunlight reflected into the instrument.

Solar Motor, a mechanism for securing motive power from the sun. For many years the attention of inventors has been directed to the question of utilizing the direct rays of the sun as a substitute for coal, wood, or other fuel; large burning-glasses or reflectors being the general form of the various machines. A so-called "burning mirror," made in France by Villette, was four feet in diameter, and produced so intense a heat that, according to the report, it melted cast iron in 16 seconds. In England, a Mr. Parker years ago built a lens about three feet in diameter, which melted a cube of cast iron in three seconds, and granite was fused in one minute. This result was produced from a concentrating surface of seven square feet; which suggests that if the reflector could be made so that the field of concentration would be a square mile the iron would melt in less than a millionth of a second, suggesting the possibilities in this direction with enormous reflectors, or groups of small ones. It was for a long time difficult to build a concave mirror of very large size, but this was finally overcome by having the surface of the concave mirror covered with small pieces of glass, or mirrors, each of which is so placed that the light or reflection from each side is thrown upon the same spot, the sum total, or the amount of heat centralized, being equivalent to the amount reflected by each glass, multiplied by the number of mirrors. In Europe the early solar glasses were generally of two kinds; that is, the heat was concentrated in two ways — by reflection from polished concave mirrors and by refraction through a convex lens. The earliest use, centuries ago, of such a contrivance was theoretically to dazzle or blind an enemy, metal disks being employed; but nearly all such devices failed to be of any practical value. Sir William Herschel experimented with the sun's heat in Africa; and Captain Ericsson made a number of studies in this direction

Digitized by Google

and exhibited a solar motor in New York in 1884.

Within recent years a successful sun motor has been built at South Pasadena, Cal., and here an automatic engine is run by the heat of the sun. In appearance the motor resembles a huge disk of glass, and at a distance might be taken for a windmill; but the disk is a reflector 33 feet 6 inches in diameter on top, and 15 feet on the bottom. The inner surface is made up of 1,788 small mirrors, arranged so that they concentrate the sun upon the central or focal point. Here is suspended the boiler, which is 13 feet 6 inches in length, and holds 100 gallons of water, leaving eight cubic feet for steam. The motor is attractive in appearance; built lightly, supported by seeming delicate shafts, though in reality strong enough to resist a wind pressure of 100 miles an hour. The reflector must face the sun exactly, and as heavy as it is, weighing tons, it can be easily moved. It stands, after the fashion of the telescope, upon an equatorial mounting, the axis being north and south; the reflector follows the sun, regulated by a clock, the work being automatic, as, in fact, is everything about it. The true focus is shown by an indicator, and in about an hour after it is adjusted the boiler is seen to have attained a white heat and the steam gauge registers 150 pounds. The steam is carried from the suspended boiler to the engine in a flexible phosphor-bronze tube and returns again from the condenser to the boiler in the form of water, so that the boiler is kept automatically full. The engine is oiled automatically, and when the disk is once turned, facing the sun, it runs all day as independent of an engineer as does a windmill. The amount of heat concentrated in the boiler by the 1,788 mirrors cannot be realized, as nothing can be seen but a small cloud of escaping steam; but should a man climb upon the disk and cross it he would literally be burned to a crisp in a few seconds. Copper is melted in a short time, and a pole of wood thrust into the magic circle flames up like a match. That the motor is a success is seen by the work it is doing — pumping water from a well, illustrating the possibilities of cheap irrigation and lifting 1,400 gallons a minute. The motor has produced results equal to 10 horsepower. In the cloudless regions of the West the solor motor promises to give a great impetus to the development of arid lands.

Solar Parallax. See PARALLAX.

Solar Star. See STARS.

Solar System, that collection of bodies of which the earth on which we dwell is one, and which are distinguished from all other bodies in the universe by having the sun as the centre of their motions. The bodies of this system may be classified as follows:

1. *The Sun.*— The great central body, shedding its light and heat on all the other bodies and, by its powerful attraction, keeping them in their several orbits. It is the fountain-head of all life on the earth. It is about 750 times as massive as all the other bodies of the system put together; hence its attractive power on all these bodies. For a full description of this great luminary, see SUN.

2. *The Planets.*— Bodies which revolve round the sun in elliptic orbits, generally differing little from circles. The planets are opaque, and are therefore visible to us only by reflecting the light of the sun. They are divided into two classes, *major* and *minor planets.*

The major planets are eight in number; their names, distances and many other particulars respecting them will be found in the table appended to this article. It will be seen that the most distant, Neptune, is more than 70 times as far from the sun as the nearest, Mercury. An idea of the arrangement of the planets will be gathered from the accompanying plate.

It will be noticed by the plate that there is a gap between the orbits of Mars and Jupiter. This is filled by the second class of planets, called *minor planets* or *asteroids.* These bodies are much smaller than the major planets, and generally revolve in more eccentric orbits. It is impossible to say exactly how numerous they may be; more than 600 are now known, new ones constantly being discovered, and there may be hundreds, or even thousands, so small that they have not been discovered, and may never be separately recognized. See ASTEROIDS.

3. *The Satellites of the Planets.*— All the major planets, with the exception of the two inner ones, have one or more smaller bodies revolving round them and accompanying them in their courses round the sun. In this respect each of the planets having satellites may be said to form a solar system in miniature, since the motion of the satellites round the planet is quite similar to that of the latter round the sun. The number of satellites is as follows:

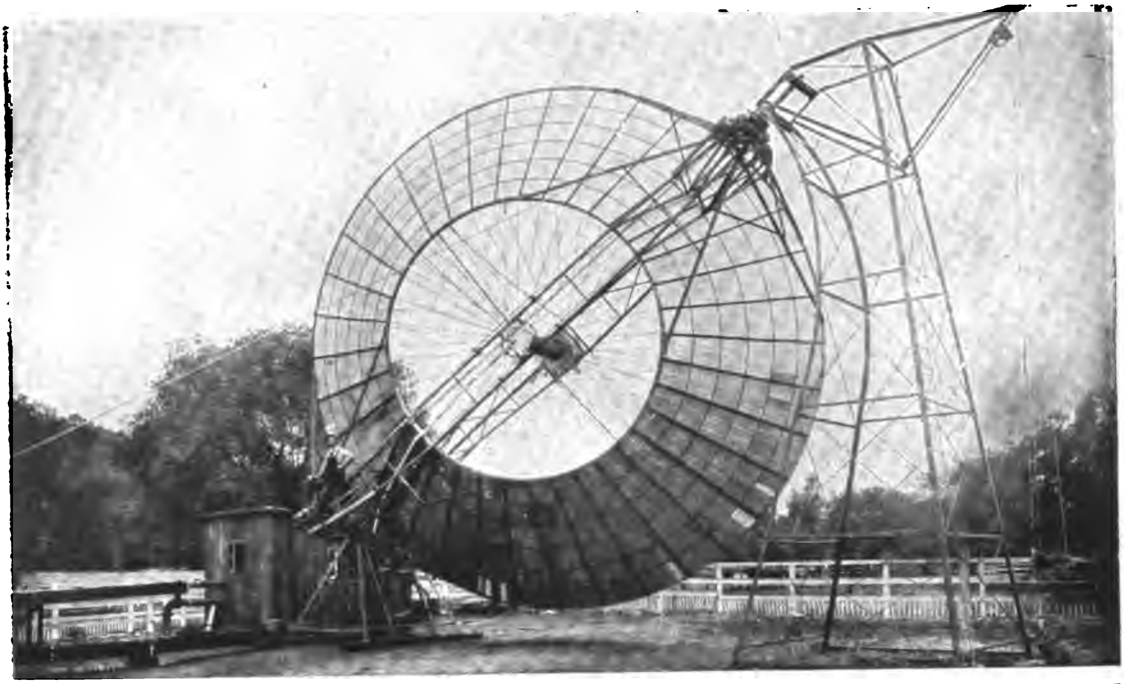
	Satellites
The Earth	1
Mars	2
Jupiter	5
Saturn	8
Uranus	4
Neptune	1

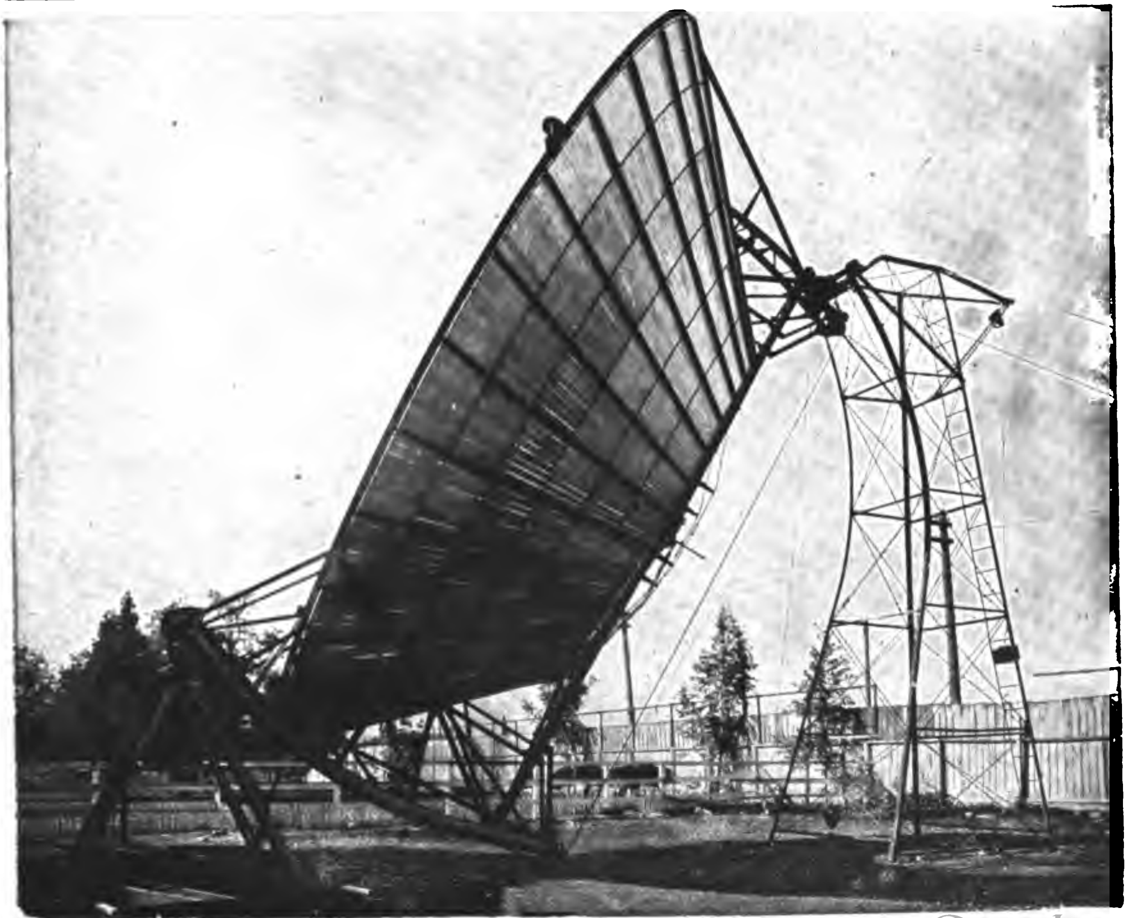
There are, therefore, 21 satellites now known. The system formed by a planet and its satellites is designated by the name of the planet. Thus we have the Martian System, the Jovian System, the Saturnian System, etc.

4. Yet another class of bodies are comets and meteoric bodies. Comets generally revolve in orbits so eccentric that, during the greater part of their course, they are entirely invisible, even to telescopic vision. A few are known to revolve within the orbit of Jupiter, and all that we can observe must have their perihelion not more than two or three times as far as the earth's orbit — otherwise they would be forever invisible. Their times of revolution vary all the way from three years to unknown thousands of years. Those having long periods go far beyond the orbit of Neptune during their course. No limit can be set to their number. Kepler's remark that the heavens may be as full of comets as the sea of fish, though probably an exaggeration, is well fitted to give an idea of the possible number of these bodies. It is certain that only an insignificant fraction of the total number has ever been seen by human eye. See COMETS.

5. The meteorites or meteors, which must be countless millions of millions in number, are so minute that we never see them individually except when they strike our atmosphere and form a shooting star. (See METEORS.) They may be classed with comets, because the latter are probably of meteoric constitution; perhaps made up of meteors.

Digitized by Google





SUN (OR SOLAR) MOTOR.
Back and Side Views of the Reflector.

Digitized by Google

A remarkable feature of the solar system is the clear separation of the eight major planets into two groups, equal in numbers, each comprising four planets with distinctive characteristics. The inner four, of which our earth is one, are dense and highly compressed solid bodies. The four planets of the outer group are many times more massive than the inner ones, the least massive of all, Uranus, being seven or eight times as weighty as the four inner ones put together. As compared with the inner group, the planets of the outer group are also distinguished by being larger in a yet greater proportion than they are massive. Any one of the inner group would be a small object alongside the smallest of the outer group. A similarity of constitution also seems to mark the outer planets; it is highly probable that all are surrounded by dense atmospheres — in fact, that each consists of a comparatively small nucleus surrounded by a gaseous envelope with clouds floating in it as they do in our atmosphere.

Possible Unknown Planets.— The excessive motion of the perihelion of Mercury, as well as the general interest in the subject, raises the question as to other planets, and has led to very careful searches for planets between Mercury and the sun. If such planets exist, they must, from time to time, pass between us and the sun, so as to be visible on the disk of the latter. Several observers, studying the sun, have supposed that they saw such objects. But there is no doubt that they were mistaken. For 20 years past the sun has been photographed almost every day, as well as constantly scanned by the telescope, in Europe and in America. No photograph has ever shown, and no really experienced observer has ever seen anything of the sort. If such bodies exist they must, therefore, be too small to be seen projected on the sun. Another way of detecting such bodies would be by scanning the neighborhood of the sun during total eclipses. This has been done at almost every such eclipse during the last 30 years. Moreover, in recent times, photography has been called to the aid of the search, especially by the Lick Observatory, in California. In one of the attempts, stars were photographed down to nearly the eighth magnitude; but nothing was ever found except known stars. We may therefore regard the non-existence of any visible planet between Mercury and the sun as well proved.

The question whether there may be a planet beyond Neptune is not so easily settled. We can only say that no such planet has ever been found, and that there is no evidence of any action on Uranus or Neptune, which we should attribute to an unknown body.

The planets are all so distant from us that, to the naked eye, they appear like stars. For the most part the five nearest to us would be classed among the brightest of the stars, Venus and Jupiter being generally brighter than any fixed star. They are also distinguished from the stars by their apparent motions, which may be seen by watching them from night to night. Their apparent situations relatively to the sun are called *aspects*. The latter are different according to whether the orbit of the planet is inside or outside that of the earth; that is, whether it is an inferior or superior one. A glance at the arrangement of the system will show that the inferior planets, Mercury and Venus, can never be seen in the opposite direction from the sun, but only seem to swing back and forth on each side of the sun as they perform their revolutions around this luminary. Their apparent distance east or west from the sun at any time is called their *elongation*. At the greatest elongation, Venus is about 45 degrees from the sun, and Mercury at different distances, generally ranging between 20 and 30 degrees, according to its position in its very eccentric orbit. But the superior planets seem to course relatively to the sun all the way round the sky in performing their revolution. When in the opposite direction from the sun they are said to be in *opposition*. This is the most favorable time for observing them, because they are then nearest to the earth, and their visible hemisphere is fully illuminated. They then rise about the time of sunset, and cross the meridian about midnight.

The inferior planets pass by the sun during their apparent swinging from one side to the other. When they pass on our side of the sun they are said to be in *inferior conjunction;* when beyond the sun, in *superior conjunction*. These conjunctions take place at fairly regular intervals. The best time to see an inferior planet is in the evening, some time before inferior conjunction; or in the early morning twilight, some time after it.

The elements of the planets and their satellites are given in the following tables. The plate shows the most important relations existing among the elements of the planets:

Planet	Distance from the Sun			Distance from the Earth		Time of Revolution round the Sun	Synodic Revolution
	Mean	Greatest	Least	Greatest	Least		
	Miles	Miles	Miles	Miles	Miles	Mean Solar Days	Mean Solar Days
Mercury	36,000,000	43,400,000	28,600,000	134,800,000	50,900,000	87.9693	115.887
Venus	67,200,000	67,700,000	66,700,000	161,200,000	24,500,000	224.7008	583.920
The Earth	92,900,000	94,500,000	91,300,000	....	....	365.2524	....
Mars	141,500,000	154,700,000	128,300,000	248,600,000	34,500,000	686.9796	779.936
Jupiter	483,000,000	506,600,000	460,000,000	599,500,000	367,200,000	4332.5882	398.884
Saturn	886,100,000	935,800,000	836,400,000	1,027,200,000	745,100,000	10759.2364	378.093
Uranus	1,782,000,000	1,864,500,000	1,699,600,000	1,956,900,000	1,607,300,000	30688.3904	369.656
Neptune	2,792,000,000	2,817,000,000	2,767,000,000	2,909,100,000	2,675,000,000	60181.1132	367.486

Digitized by Google

Planet	Time of Rotation on Axis			Inclination of the Planet's Equator to its Orbit		Equatorial Diameter	Volume, Earth's = 1	Mass, Earth's = 1	Density, Earth's = 1	Force of Gravity, Earth's = 1	Bodies fall in second	Apparent Diameter as seen from the Earth	
												Greatest	Least
	H.	M.	S.	Deg.	Min.	Miles					Feet	Sec.	Sec.
Mercury..		?			?	3,000	0.052	0.061	1.173	0.439	7.06	12.9	4.6
Venus....		?			?	7,700	0.975	0.787	0.807	0.802	12.90	65.2	9.5
The Earth	23	56	4	23	27	7,927	1.000	1.000	1.000	1.000	16.08	....	....
Mars.....	24	37	23	24	50	4,230	0.147	0.105	0.711	0.376	6.05	24.5	3.6
Jupiter....	9	55	37	3	5	88,200	1279.412	309.816	0.242	2.261	36.36	50.0	32.0
Saturn....	10	14	24	26	49	75,000	718.883	91.919	0.128	0.892	14.34	20.0	14.0
Uranus...		?			?	32,000	69.237	13.518	0.195	0.754	12.12	4.1	3.8
Neptune..		?			?	35,000	54.955	16.469	0.300	1.142	18.36	2.9	2.7

SIMON NEWCOMB.

Solar Time. See DIAL; SUN.

Solario, Andrea da, än'drā-ä dä sō-lä'rē-ō, Italian painter: b. Solario 1460; d. 1515. He lived in Venice 1490 to 1493 with a brother, Cristoforo, who was an architect and sculptor. In 1507 he was in Normandy. His best known works are: 'Ecce Homo,' 'Repose in Egypt' (1515); 'Crucifixion' (1503); and numerous portraits.

Sol'berg, Thorvald, American writer: b. Manitowoc, Wis., 22 April 1852. As a member of the staff of the Library of Congress in 1876–89 he became interested in the question of international copyright, and was a delegate to the several European congresses. His most notable works are: 'International Copyright in the Congress of the United States' (1886), and 'The Copyright Law in Force in the United States in 1900' (1900).

Soldanella, in botany, a genus of plants of the order *Primulaceæ*. They are small herbs, inhabiting the alpine districts of southern Europe, corolla sub-campanulate, of one cleft and fringed on the margin. *Soldanella alpina* having blue flowers, frequenting the hills of Switzerland, is an object of extensive culture in England.

Solder, sŏd'ẽr, a cement of metal or metallic alloy. Solders consist of simple or mixed metals, by which ordinarily metallic bodies are firmly united with each other. As a rule, the solder should be easier of fusion than the metal it is meant to be used on. The solder should also be, as far as possible, of the same color as the metal. For the simple solders each of the metals may be used, according to the nature of that which is to be soldered. For fine steel, copper, and brass work gold or silver may be employed. But, broadly speaking, iron is soldered with copper, and copper and brass with tin. The most usual solders are the compound, which are distinguished into two principal classes, hard and soft. The hard solders are ductile, will bear hammering, and are commonly prepared of the same metal as that which is to be soldered, with the addition of some other, by which a greater degree of fusibility is obtained, though the addition is not always required to be itself easier of fusion. Under this head comes the hard solder for gold, which is prepared from gold and silver, or gold and copper, or gold, silver, and copper. The hard solder for silver is prepared from equal parts of silver and brass, but is made better for fusion by the admixture of 1-16 of zinc. The hard solder for brass is obtained from brass mixed with a sixth, or an eighth, or even one half of zinc, which may also be used for the hard solder of copper. The soft solders melt easily, but are partly brittle, and therefore cannot be hammered. Tin and lead in equal parts make a good soft solder. Of easier fusion is that consisting of bismuth, tin, and lead in equal parts. In the operation of soldering, the surfaces of the metal to be joined must be made very clean, and applied to each other. It is usual to secure them by a ligature of iron wire, or other similar contrivance. The solder is laid upon the joint, together with sal-ammoniac and borax, or common glass, according to the degrees of heat intended. These additions defend the metal from oxidation. Glaziers use resin; and pitch is sometimes employed. Tin-foil, applied between the joints of fine brass work, first moistened with a strong solution of sal-ammoniac, makes an excellent juncture, care being taken to avoid too much heat. See ALLOY.

Soldiers of Fortune. See MERCENARIES.

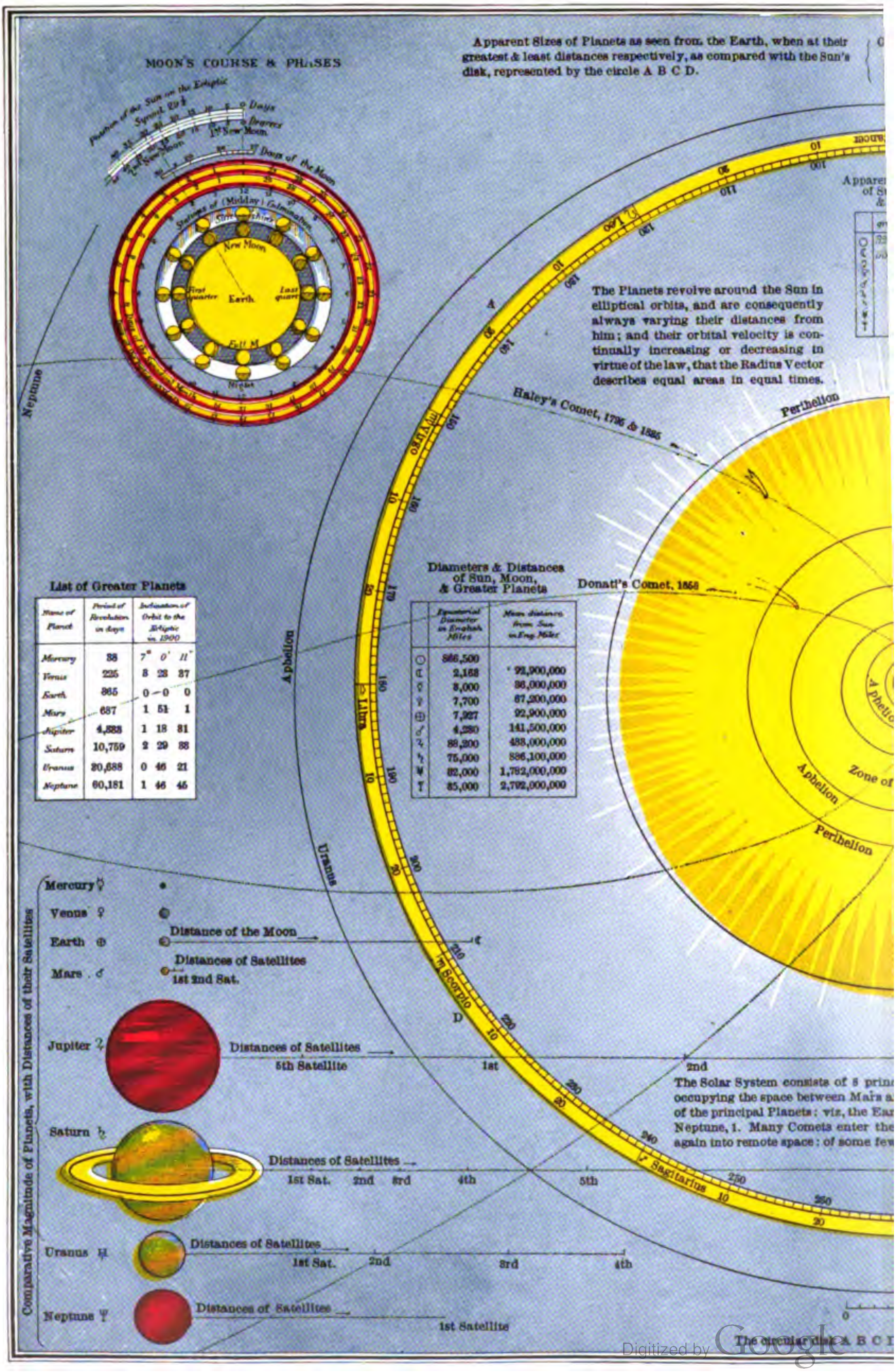
Soldier Beetle, the name given to the beetle of the tribe *Telephoridi*, family *Malacodermidæ*. The larvæ generally feed upon plant-lice, caterpillars, or other soft-bodied insects. The most common specie in the eastern part of the United States is the *Chauliognathus Pennsylvanicus*, a native of Pennsylvania, which are specially valuable as cross-fertilizers of plants.

Soldiers' Homes, the general name of various institutions in the United States, under national or State control, for the care of sick and disabled soldiers and sailors. These homes were the direct outcome of the Civil War. The Federal institution is known as the National Home for Disabled Volunteer Soldiers and has branches at Dayton, Ohio; Milwaukee, Wis.; Togus, Maine; Hampton, Va.; Leavenworth, Kan.; Santa Monica, Cal.; Marion, Ind.; and Danville, Ill. In 1903 aggregate number of inmates was about 27,000.

The requirements for admission are: (1) An honorable discharge from the United States service. (2) Disability which prevents the applicant from earning his living by labor. (3) Applicants for admission will be required to stipulate and agree to abide by all the rules and regulations made by the board of managers or by its order; to perform all duties required of them, and to obey all the lawful orders of the

Digitized by Google

Digitized by Google



List of Greater Planets

Name of Planet	Period of Revolution in days	Inclination of Orbit to the Ecliptic in 1900		
Mercury	88	7°	0′	11″
Venus	225	3	23	37
Earth	365	0	— 0	0
Mars	687	1	51	1
Jupiter	4,333	1	18	31
Saturn	10,759	2	29	33
Uranus	30,688	0	46	21
Neptune	60,181	1	46	45

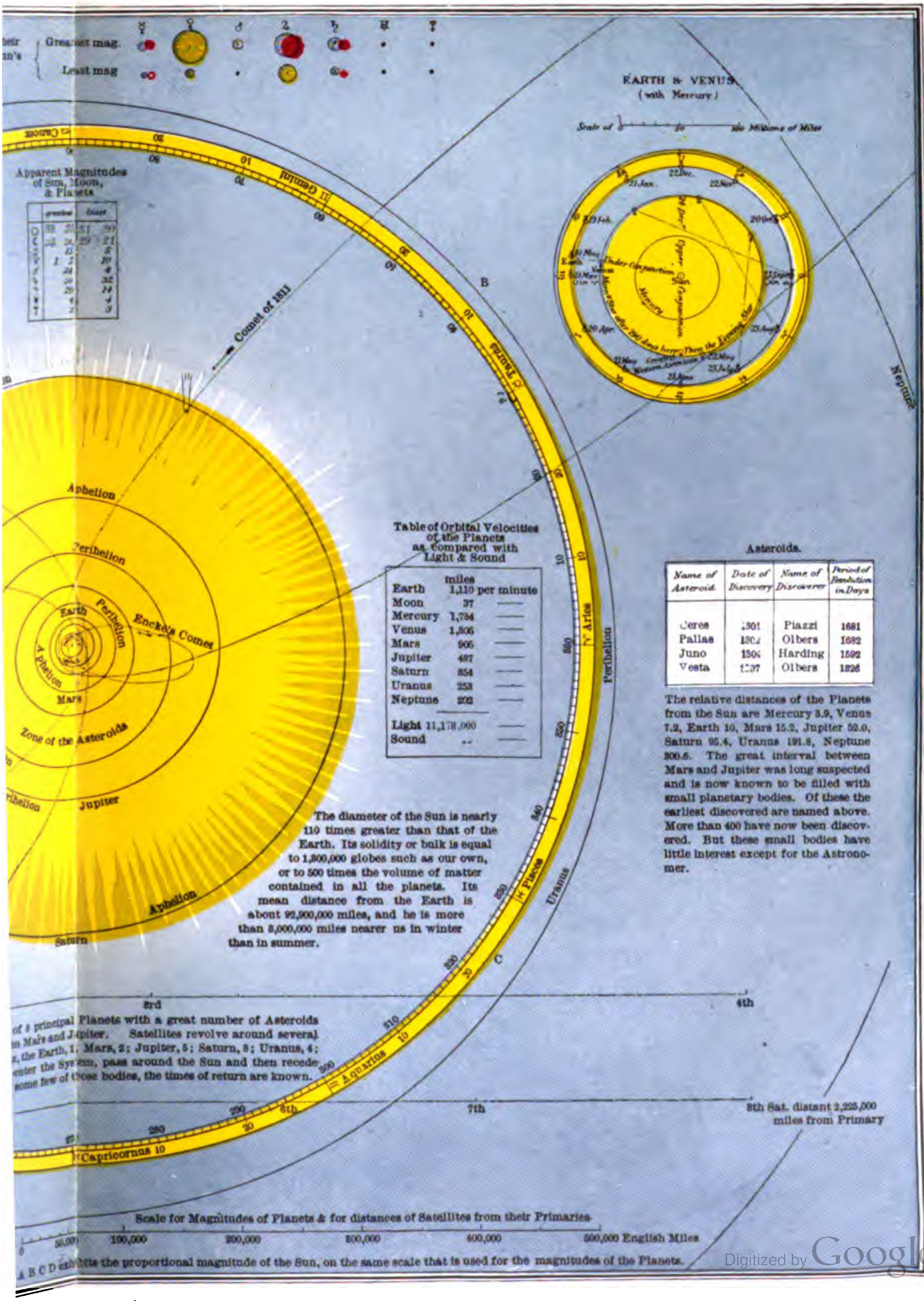
Diameters & Distances of Sun, Moon, & Greater Planets

	Equatorial Diameter in English Miles	Mean distance from Sun in Eng. Miles
☉	866,500	
☾	2,163	92,900,000
☿	3,000	36,000,000
♀	7,700	67,200,000
⊕	7,927	92,900,000
♂	4,230	141,500,000
♃	88,200	483,000,000
♄	75,000	886,100,000
♅	32,000	1,782,000,000
♆	35,000	2,792,000,000

Digitized by Google

RELATIVE POSITIONS, MAGNITUDES

SOLAR SYSTEM



Digitized by Google

UDES, ORBITS, ETC., OF THE HEAVENLY BODIES

Digitized by Google

officers of the Home. Attention is called to the fact that by the law establishing the Home the members are made subject to the Rules and Articles of War, and will be governed thereby in the same manner as if they were in the army of the United States. (4) A soldier or sailor must forward with his application for admission his discharge paper, and when he is a pensioner, his pension certificate, and if he has been a member of a State Home, his discharge from that Home, before his application will be considered; which papers will be retained at the branch to which the applicant is admitted, to be kept there for him, and returned to him when he is discharged. The rule is adopted to prevent the loss of such papers and certificates, and to hinder fraudulent practices; and no application will be considered unless these papers are sent with it. If the original discharge does not exist, a copy of discharge, certified by the War or Navy Department, or by the adjutant-general of the State, must accompany the application. Soldiers or sailors whose pensions exceed $16 a month are not eligible to the Home unless the reasons are peculiar and are explained to the manager and are satisfactory to him. Those who have been members of the State Homes must have been discharged from those Homes at least six months before they can be admitted to a branch of the National Home, except by a vote of the board of managers.

The United States Soldiers' Home at Washington, D. C., receives and maintains discharged soldiers of the regular army. All soldiers who have served 20 years as enlisted men in the army (including volunteer service, if any), and all soldiers of less than 20 years' service who have incurred such disability, by wounds, disease, or injuries in the line of duty while in the regular army, as unfits them for further service, are entitled to the benefits of the Home. A pensioner who enters the Home may assign his pension, or any part of it, to his child, wife, or parent, by filing written notice with the agent who pays him. If not so assigned it is drawn by the treasurer of the Home and held in trust for the pensioner.

The board of commissioners consists of the general-in-chief commanding the army, the surgeon-general, the commissary-general, the adjutant-general, the quartermaster-general, the judge-advocate-general, and the governor-general of the Home.

There are State Homes for disabled volunteer soldiers provided by the States of California, Colorado, Connecticut, Idaho, Illinois, Indiana, Iowa, Kansas, Massachusetts, Michigan, Minnesota, Missouri, Montana, Nebraska, New Hampshire, New Jersey, New York, North Dakota, Ohio, Oregon, Pennsylvania, Rhode Island, South Dakota, Vermont, Washington, Wisconsin, and Wyoming.

Sole, a European flatfish (*Solea vulgaris*), one of the most familiar of British food-fishes. The average length is about 12 inches and the weight about 18 ounces, and the flesh is very palatable and nutritious. These fishes are usually captured by the trawl-net, and sometimes by the line. They inhabit the shallow waters of sandy coasts, and sometimes ascend rivers to spawn. Other species of soles are the lemon sole (*S. pegusa*), the variegated sole (*S. variegata*), which has a reddish-brown color marked with darker brown bands; and the solenette or little sole (*S. linguatulus*), the average length of which is about five inches. The transparent sole (*Achirus pellucidus*) of the Pacific Ocean, which wants the pectoral fins; and the zebra sole (*S. zebrina*) of Japan, are also well-known species. The nearest American representative is a small closely allied fish, called hog-choker (*Achirus fasciatus*), common along the Eastern coast, but not regarded as worth eating.

Solemn League and Covenant. See COVENANT.

Solenhofen, zō'lĕn-hō-fĕn, or **Solnhofen,** zōln'hō-fĕn, Germany, a village of western Bavaria, 36 miles south of Nuremberg. The quarries in its neighborhood yield the best lithographic stones in the world. See LITHOGRAPHY.

Sole'noid, in electricity, a copper helix wound in the form of a cylinder and equivalent to a number of equal and parallel circular circuits arranged upon a common axis.

So'lent, England, the western part of the strait of the English Channel separating the Isle of Wight from the mainland. It is 17 miles long and three miles wide, and forms a safe roadstead.

Soley, sō'lĭ, **James Russell,** American naval historian: b. Roxbury, Mass., 1 Oct. 1850. He was graduated from Harvard in 1870, and in the following year was appointed professor in the Department of English at the United States Naval Academy at Annapolis. He was commissioned a commander in 1882, and stationed at Washington, D. C., in charge of the naval library there. From 1885 to 1889 he lectured upon naval history and international law in various Eastern colleges, and in 1890 was appointed assistant secretary of the navy. In 1893 he resigned this office and took up the practice of law in New York. He edited and conducted the publication of the naval history of the Civil War, and is the author of 'The Campaigns of the Navy in the Civil War' (1883); 'The Naval Wars of the United States'; 'Maritime Industries of America'; etc.

Solfaing, sōl'fä-ĭng, signifies to exercise the voice upon the syllables do, re, mi, fa, sol, la, si (solmization), used to designate the notes of the diatonic scale. Pieces without text intended for this sort of exercise, are called *solfeggi*. Sometimes this word is applied also to instrumental music (for example, on the piano), and then those pieces are meant which are merely intended to exercise the learner in reading notes and hitting intervals. See SOL-FA SYSTEM.

Solfata'ra, the Italian name for a kind of volcanoes found in various parts of the earth, which, though not in a state of actual eruption, give out sulphurous gases and vapors. The most notable are found in Italy, in the Antilles, in Mexico, in the interior of Asia, and in Java. Probably the best known are those between Rome and Tivoli, and that at Pozzuoli, near Naples. This last is an irregular plain almost surrounded by the walls of an ancient crater. From the crevices rise steam and gases, chiefly sulphuretted hydrogen, mixed with minute quantities of muriatic acid and muriate of ammonia. The cracks and fissures of the rocks abound with sulphur, alum, and sulphate of iron.

Digitized by Google

Solfeggio, sŏl-fĕj'ī-ō, in music, a vocal exercise, in which the syllables ut (or do), re, mi, fa, sol, la, si — corresponding to C, D, E, F, G, A, B — are used instead of words. Their use as a method of nomenclature originated, as far as the first six are concerned, in the 11th century with Guidó Aretinus, who substituted his hexachord system for the old Greek tetrachords. Observing in the melody of an ancient hymn for the festival of Saint John the Baptist, beginning

Ut queant laxis *Re*sonare fibris
*Mi*ra gestorum *Fa*muli tuorum
*Sol*ve polluti *La*bii reatum
Sancte *I*oannes,

that the notes on which the successive phrases began were identical in order with the sounds of the hexachord, he adopted the syllables to which they were allied in the above stanza as names to represent the degrees of his new scale. When, early in the 17th century, the octave was completed by the seventh or «leading note,» the syllable Si, formed of the initials of «Sancte Ioannes,» was added; while Do generally took the place of Ut, as being more easily sung. This illustration of the construction of the musical scale by the use of the syllables is called solmization.

Solferino, sŏl-fĕ-rē'nō, Italy, in the province of Mantua, and 18 miles northwest of the town of that name. From its commanding position of the Plain of Lombardy, its tower has acquired the title of «Spy of Italy.» In 1859, the battle fought here between the Austrians on the one hand and the allied French and Sardinian troops, under Napoleon III., on the other, resulted in the defeat of the former. In this bloody conflict the Austrians lost 20,000 men, their adversaries 18,000.

Solicitor. See Attorney; Barrister.

Solicitor-general, an officer of the British crown, next in rank to the attorney-general, with whom he is in fact associated in the management of the legal business of the crown, and public offices. The solicitor-general of Scotland is one of the crown-counsel, next in dignity and importance to the lord-advocate.

Solid, in geometry, a magnitude having three dimensions — length, breadth, and thickness. A solid in physics is a body characterized by invariability of form; so much so, that the motion of one of its parts produces motion in the whole.

Solid-shot. See Projectiles.

Solidago. See Golden-rod.

Solidification, the passage of a substance into the solid state, either from a state of solution or fusion, or directly from the gaseous state. The term is usually applied, however, to the transition from the melted state into the solid form, and it is only in this sense that it will be here discussed. Some substances which are stable in the solid form cannot be melted without undergoing decomposition, either partial or complete; but many others can be converted into the liquid form by the mere addition of heat, passing back into the solid form again when the heat is abstracted. In general, fusion implies an addition of heat energy, and solidification implies its abstraction. Thus, to freeze one pound of water it is necessary to abstract from it an amount of heat energy that would be sufficient to raise the temperature of a pound of liquid water by about 140 degrees on the Fahrenheit scale; and in order to melt the pound of ice a precisely equal quantity of heat energy must be added to it again. All liquids may de divided into two general classes, whose laws of solidification are apparently very different. The first class includes bodies such as wax and glass, which, when they are cooled, pass into the solid state by a transition so gradual that it is impossible to assign any definite temperature at which the transformation can be considered to take place. The other class includes substances which, like water, do not begin to solidify until they have been cooled to a certain definite temperature peculiar to each substance. Solidification then begins at once, and it progresses continually, as the heat is abstracted, the temperature of the mass remaining unchanged until all of the liquid has been transformed into the solid form. In some cases the solid body that is obtained is crystalline in structure, and in other cases it is amorphous. In general, the temperature or solidification of a substance is identical with the melting point of the same substance; but in some cases the molten condition persists until the mass has been cooled to a temperature materially lower than the temperature of fusion. The rare metal known as gallium, for example, melts at 86° F.; but when once melted it may be cooled to about 36° F. before it solidifies. This phenomenon — the persistence of the molten condition after the substance has been cooled below the normal melting point — is called surfusion, and it may be regarded as analogous to the supersaturation that is sometimes observed in solutions (q.v.). If a small fragment of solid gallium be added to the molten metal at a temperature below 86° F., solidification at once ensues; and in general it may be said that in any fluid substance in a state of surfusion solidification is at once induced by the addition of a fragment of the same substance in a solid form. Some substauces increase in volume when they pass from the molten to the solid state, and others decrease. For example, when water solidifies it increases in volume so that the bulk of the ice that is formed is about one eleventh greater than that of the original water. Cast-iron, bronze, and other metals which give good sharp castings also increase in volume upon solidification. Lead, on the other hand, decreases in volume when it passes from the liquid to the solid state.

Pressure has a slight influence upon the temperature of solidification; and Dr. James Thomson showed, from theoretical principles, that under great pressures the temperature of solidification is lowered in bodies which expand upon solidification, and raised in those in which solidification is accompanied by contraction; this theoretical prediction having been subsequently verified by direct experiment.

Solidun'gula, or **Perissodactyla,** a division of the mammalian order *Ungulata* (q.v.), represented by the horses, asses, zebras, etc., distinguished primarily by the fact that the feet have each a single well-developed toe only, encased in a broad «hoof.»

Sol'idus, a Roman coin originally called aureus (q.v.).

Solingen, zō'lĭng-ĕn, Germany, in Prussia, in the Rhine Province, stands on a hill bordering

Digitized by Google

the Wupper River, 20 miles northeast of Cologne. It has Catholic and Protestant churches, a synagogue, schools of various grades, hospital, electricity, and all the conveniences of a modern town. It is the centre of the steel and iron industry in Germany, and especially famous for its sword-blades. There are 40 metal manufactories which turn out fine cutlery, copper and brass-ware, surgical instruments, etc., while several thousand workmen make small articles of cutlery at home. There are besides paper, linen, cotton, silk, soap, and other factories. Solingen cutlery has been famous since mediæval times and is supposed to have been introduced by crusaders from Damascus.

Solis, Juan Diaz de, hoo-än' dē'äth dā sō-lēs', Spanish navigator: he is supposed to have been born at Lebrija, Spain, about 1470. In 1506 he accompanied the navigator Pinzon in his expedition in search of a western passage to India, and upon this voyage touched the shores of Central America, and explored the Caribbean Sea as far south as Honduras. In 1508 they reached lat. 40° S. and explored the Bay of Rio de Janeiro. In 1515 he sailed from Spain in command of three vessels with the expectation of making further progress in his quest of the Eastern world, and upon this voyage discovered the Plata, which was originally named for him. He was killed by the Indians upon this voyage.

Solis, zō'lĭs, **Virgilius,** German designer and copperplate engraver: b. Nuremberg 1514; d. there 1 Aug. 1562. He began by following the style of Kleinmeister, an imitator of Dürer, but soon lapsed into characterless mannerism which appears in most of his copperplates (some 650 in number), his woodcuts, and his pen and ink drawings. His favorite subjects were taken from mythology and history, but he also drew and engraved religious pictures, many portraits, and scenes from contemporary life. He finally executed work in the Italian style exclusively. A facsimile of his ‹Wappenbüchlein› (Handbook of Heraldry) was published at Munich in 1886.

Solis y Ribadeneira, sō-lēs'ē rē-bä-thā-nā'-rä, **Antonio de,** Spanish dramatist and historian: b. Alcalá de Henares 8 July 1610; d. Madrid 19 April 1686. He read law at the University of Salamanca, and at 17 years of age wrote a comedy which was produced there. He is known to have been the author of at least nine plays, the most noted among which are ‹Love à la Mode› and ‹The Gipsy of Madrid.› In 1654 he was appointed secretary to Philip IV., and shortly afterward was made historian to the Court of Spain. His name is most prominently connected with a historical account of the conquest of Mexico by Cortes, which he published in 1684 under the title: ‹Historia de la Conquista de Mejico.›

Solitaire, sŏl-ĭ-tār', a flightless bird (*Pezophaps solitarius*), which has become extinct within comparatively recent times. It inhabited the islands of Bourbon and Rodriguez until about 1760. It was related to the dodo (q.v.), and was described by Leguat, a French voyager, who dwelt in the islands in 1691, and who says that the males were of a «brown-gray color,» the feet and beak being like a turkey's, but «more crooked.» He notes that the tail was inconspicuous in size, the hinder parts being rounded; the neck was straight, and the eye black and lively. «They never fly,» says Leguat; «their wings are too little to support the weight of their bodies; they serve only to beat themselves, and to flutter when they call one another.» Some of the males were said to weigh 45 pounds. Consult Newton, ‹Dictionary of Birds› (New York 1896).

Solitaire, a game played by one person on a board indented with 33 or 37 hemispherical hollows, with an equal number of balls. One ball is removed from the board, and the empty hollow thus left enables pieces to be captured singly as in draughts. The object of the player is to take all the pieces except one without moving diagonally or over more than two spaces at a time. The name is also applied to a game of cards played by one person.

Sol'ly, Samuel Edwin, American physician: b. London, England, 5 May 1845. He studied medicine in London and practised there until 1874, at which time he came to America and settled in Colorado. He has published ‹Handbook of Medical Climatology›; ‹Tubercular Laryngitis›; ‹The Influence of Altitude upon the Blood›; etc.

Solmiza'tion. See SOLFEGGIO.

Solnhofen (zōln'hō-fĕn) **Beds** (SOLENHOFEN incorrectly), deposits of a peculiar character in the Jurassic strata of Bavaria, and deriving their name from the town of Solenhofen, near which and Mönsheim, Eichstädt, and Hofstetten in the valley of the Altmühl, they are obtained. They have acquired a world-wide use as lithographic stone. The rock varies from a nearly pure carbonate of lime (over 99 per cent) to one in which a moderate amount of silica is present. These latter portions are very thin-bedded, often appearing to have a slaty structure. All are exceedingly fine and uniform in grain, representing the deposits of an impalpable lime-flour or lime-mud in quiet though shallow lagoons surrounded by growing coral reefs. These fine lime-mud rocks (Calcilutytes) are often rendered impure by the admixture of dust blown by the winds from the distant land and settling in the waters of the shallow lagoons. In these layers were imbedded dragon-flies and other insects, which were brought from the lands and whose remains, beautifully preserved, are found to-day in these thinner bedded and more impure layers, together with those of marine as well as other aerial animals. Most noteworthy among these latter are the flying reptiles, Rhamphorhynchus and Pterodactylus, and the primitive bird Archæopteryx, whose skeleton shows so many reptilian characters as to constitute this animal a veritable connecting link between reptiles and birds. See LITHOGRAPHIC STONE.

Solomon, sŏl'ō-mŏn: b. 1033 B.C.; d. 975 B.C.; the son of David, king of Israel, by Bathsheba, formerly the wife of Uriah, was appointed by David to be his successor in preference to his elder brothers. By his remarkable judicial decisions, and his completion of the political institutions of David, Solomon gained the respect and admiration of his people; while by the building of the temple, which gave to the Hebrew worship a magnificence it had not hitherto possessed, he bound the

Digitized by Google

nation still more strongly to his throne. The wealth of Solomon, accumulated by a prudent use of the treasures inherited from his father; by successful commerce; by a careful administration of the royal revenues; and by an increase of taxes,— enabled him to meet the expense of erecting the temple, building palaces, cities, and fortifications, and of supporting the extravagance of a luxurious court. Fortune long seemed to favor this great king; and Israel, in the fulness of its prosperity, scarcely perceived that he was continually becoming more despotic. Contrary to the laws of Moses, he admitted foreign women into his harem; and from love of them he was weak enough in his old age to permit the free practice of their idolatrous worship, and even to take part in it himself. Toward the close of his reign troubles arose in consequence of these delinquencies, and the growing discontent, coming to a head after his death, resulted in the division of the kingdom, which his feeble son Rehoboam could not prevent. The 40 years' reign of Solomon is still celebrated among the Jews, for its splendor and its happy tranquillity, as one of the brightest periods of their history. The writings attributed to Solomon are the Book of Proverbs, Ecclesiastes, and the Song of Solomon, with the apocryphal book the Wisdom of Solomon; but modern criticism has decided that only a portion of the Book of Proverbs can be referred to Solomon. Consult: Alexander, 'King Solomon' (1897); Farrar, 'Solomon'; Winterbotham, 'Life and Reign of Solomon'; Hallock, 'Child's History of King Solomon.'

Solomon, Solomon Joseph, English painter: b. London 16 Sept. 1860. He studied art at the Royal Academy schools, Munich Academy, and the Ecole des Beaux Arts, Paris, and subsequently did much work during his travels in Italy, Spain and Morocco. Among his pictures are 'Cassandra' (1886); 'Sampson' (1887); 'Niobe' (1888); 'The Judgment of Paris' (1890); 'Echo and Narcissus' (1894); and many portraits.

Solomon Islands, Melanesia, a group of islands in the Pacific Ocean, belonging in part to Great Britain, in part to Germany, and situated between lat. 5° and 11° S., and between lon. 154° and 162° 30' E. It is an irregular chain stretching in a southeast direction from New Pomerania toward the New Hebrides. The group consists of the large islands of Bougainville, Choiseul, Ysabal, Malaita, New Georgia, Guadalcanar, and San Cristoval, arranged in two parallel rows, and a large number of small islands. Bougainville, the largest, is 120 miles long and 35 miles wide, and the other islands named above are but little smaller. The total area of the group is about 16,950 square miles. The islands are all elongated from northwest to southeast, and mountainous, rising in Bougainville to a height of over 10,000 feet. There are two active volcanoes and numerous extinct craters and active hot springs. The surrounding waters are beset with coral reefs which make navigation dangerous. All the islands are heavily forested, and vegetation is very luxuriant. The inhabitants are Melanesians. They have had but little communication with Europeans, and are still savages, practising cannibalism and polygamy. They cultivate the soil, and are very skilful in boat-building and wood carving. Their number is estimated at 200,000, while the European population is less than 100, mostly missionaries. The chief products of the islands are copra, trepang, pearl, tortoise-shell and sandal wood. The islands were discovered by Mendaña in 1564. By the Anglo-German conventions of 1886 and 1899 the protectorate of the islands was divided so that Germany retained Bougainville and its neighboring islets, while the remaining islands came under the protection of Great Britain. There is a British resident commissioner, and the German portion is administered from New Pomerania.

Solomon, Wisdom of. See Wisdom, Book of.

Solomon's Seal, common liliaceous plants (*Polygonatum*) arising in copses from thick, white, fleshy rootstocks. These bear circular scars left by each annual stem, upon its decay; by some, these are said to be the «seals,» while others state that the name refers to the seal-like markings seen when the stem is cut across. The European *Polygonatum multiflorum,* and the American *P. biflorum* are much alike, and the *P. commutatum* chiefly differs by being more glabrate and smaller. The Solomon's seals are now cultivated especially in wild gardens. They are apt to grow in colonies, and have slender, tough stems, bending until nearly horizontal under the weight of the numerous, sessile, broadly lanceolate leaves, which are arranged closely, alternately and flatly on either side of the top of the stem. Under this protecting roof hang bell-like, 3-merous flowers, generally in pairs on forked axillary peduncles. They are small greenish in hue and succeeded by globular berries, very dark blue, with a bloom.

False Solomon's seals or wild spikenard (*Vagnera racemosa* and *V. stellata*) are similar liliaceous but less graceful plants. They do not have seals on the roots, are likely to be larger, with pubescent and longer leaves; and the starry white flowers are gathered in panicles or racemes at the end of the drooping stems. The berries are either red, speckled with purple, or green striped with black. The *V. racemosa* is sold by city florists in its season.

Solon, sō'lŏn, Athenian law-giver: b. Athens about 640 B.C.; d. about 559. He was of a noble family and some of its members were ancestors of Codrus. Solon in early life became a trader, gathering by travel a fund of observation and experience, and thus became enrolled among the Seven Wise Men of Greece. His first appearance in public life was during the contest between Athens and Megara, for the possession of Salamis, a question he decided by quoting a passage of Homer in which Ajar is described as belonging to the Athenian armament. He appeared again as a promoter of hostilities against Cirrha in behalf of Delphi, and moved the Amphictyons to declare war. He was made archon in 594 and his preliminary measures consisted of a «disburdening ordinance» intended to alleviate the burdens of the debtor class without doing injustice to the creditor; a rearrangement of the monetary system; and a measure to control the rate of interest, and the acquisition of land. So successful did these reforms prove that he was charged with the re-

Digitized by Google

modeling of the constitution. He began by abolishing all the laws of Draco except those relating to homicide, and established the right to citizenship on a basis of property qualification. He divided the people into four classes: (1) Pentacosiomedimni,— those having a yearly income of at least 500 *medimni* (750 bushels) of corn, or *metretæ* of wine or oil. (2) Hippeis, Knights,— those having 300 *medimni*. (3) Zeugitæ,— those possessing a yoke of oxen with 150 *medimni*. (4) Thetes, workers for wages,— those with less than 150 *medimni* as yearly income. The archons could only be chosen from the first class. Members of the first three classes were alone eligible for responsible offices, and with them lay the election to such offices. The Thetes were ineligible to office, but could vote in the general public assemblies. Solon among other things regulated the levying of taxes and the military service of the citizens. He also established the Council of the Four Hundred. His code of laws regulated public and private life; he also reformed the calendar and the system of weights and measures. The laws he made were inscribed on wooden cylinders and triangular tablets and set up in public. He acknowledged, however, that these laws were not the best conceivable, but the best that the Athenians could be made to accept.

The remainder of his history belongs to the borderland of legend. He is said to have exacted a pledge from the Athenians that they would not change his laws for ten years and to have left the state for Egypt, Cyprus, and Lydia. He returned to find the old dissensions renewed in a state which was destined in a short time to fall under the tyranny of Pisistratus.

Sol'stice, in astronomy, the point in the ecliptic at the greatest distance from the equator, at which the sun appears to stop or cease to recede from the equator, either north in summer or south in winter. There are two solstices — the summer solstice, the first degree of Cancer, where the sun is about 21st of June; and the winter solstice, the first degree of Capricorn, where the sun is about the 22d of December. The time at which the sun is at either of these points also receives the same name.

Solutions. In chemistry and physics (qq.v.) a solution is usually defined as a homogeneous liquid in which two or more chemically distinct substances are simultaneously present. Many authorities, however, restrict the term to such homogeneous liquid mixtures as exhibit a definite osmotic pressure (see below). Others extend it so as to make it include gaseous mixtures, and even solid mixtures such as alloys. In the present article we shall adopt the former course, using the term to signify a homogeneous liquid mixture, which is capable of exerting a definite osmotic pressure.

When a solid substance is dissolved in a liquid, the liquid is called the «solvent,» and the solid is called the «solute.» When a solution is prepared by mixing two liquids, either one of the liquids may be regarded as the «solvent,» the other then being called the «solute»; but it is customary to consider the one which is present in largest amount as the «solvent.» By way of illustrating these terms, let us suppose that approximately equal masses of water and of anhydrous liquid carbolic acid are shaken up together. The two will not mix freely at ordinary temperatures, but the water will take up a small quantity of the acid, and the acid will similarly take up a small quantity of the water; the mixture subsiding, when the agitation ceases, into two distinct layers, carbolic acid preponderating in the lower one, and water in the upper one. The upper layer may then be regarded as a solution of carbolic acid in water, and the lower as a solution of water in carbolic acid; carbolic acid being the «solute» in the upper layer, and the «solvent» in the lower one. This distinction is evidently an arbitrary one, however, and many cases could be cited in which it would be impossible to assign any reason for regarding either constituent as the «solvent,» in preference to the other one. For example, carbolic acid and water dissolve in each other more and more freely as the temperature rises, until, at temperatures above 183° F., they mix readily in all proportions. If equal masses of these substances were mixed at 185° F., therefore, we could regard either as the solvent, and either as the solute.

When a solid substance is dissolved in a liquid, it sometimes happens that there is no marked evidence of chemical change. In other cases, however, there is a very obvious chemical change. When ordinary cane sugar is dissolved in water, a syrupy liquid results, from which the sugar may be again obtained in the same chemical condition as at first, by allowing the water to evaporate at a sufficiently low temperature. If sodium hydrate, on the other hand, is added to a given mass of hydrochloric acid until the acid is just neutralized, it is impossible to obtain either the acid or the sodium hydrate by mere evaporation of the solution. Nothing but water passes away in the vapor, and the solid substance that remains behind when the water is all gone is found to be common salt. If we choose to do so, we may regard the mixture of sodium hydrate and hydrochloric acid as a solution of the hydrate in the acid; but since we may prepare identically the same ultimate mixture by adding common salt to pure water, it is perhaps more convenient to regard it as a solution of common salt in water. For the present we shall take the latter view, confining our attention solely to those cases of solution in which a solid dissolves in a liquid without any obvious chemical change.

When a solid is added to a liquid for which it has no chemical affinity, it may remain entirely unaffected. In this case, the solid is said to be «insoluble» in the liquid, and no solution is obtained. If the solid is not insoluble in the given liquid, it gradually disappears when the two are brought together, the part which ceases to be visible passing into the liquid in the dissolved state. In some cases the change is rapid, and in others it is slow. It is always accelerated by agitating the solvent. Some solids appear to mix with certain solvents in all proportions; but in general it will be found that if the supply of the solid is sufficient, there will come a time when, under the conditions of the experiment, no more of the solid will dissolve. The solution is then said to be «saturated.» The quantity of a given solute that will dissolve in a given solvent depends upon several circumstances, but most notably upon the temperature

Digitized by Google

of the solvent, nearly all substances being more soluble at high temperatures than at lower ones. If a saturated solution of a substance that is more soluble at high temperatures than at lower ones is warmed, it becomes capable of taking up more of the solute; and if such a saturated solution is cooled, it usually deposits some of the solute, until its degree of concentration becomes reduced to that corresponding to saturation at the lower temperature. It is sometimes possible, however, to cause a solution to retain more of the dissolved solid than corresponds to saturation at a given temperature; though this «supersaturated» condition is quite unstable. Glauber's salt (that is, sulphate of sodium crystallized with ten molecules of water), exhibits supersaturation in a marked manner. If a saturated solution of this salt be prepared at a certain definite temperature, and then removed from contact with any particle of the free, undissolved salt, its temperature may be lowered by a considerable amount before crystallization sets in. If the smallest fragment of the solid salt is placed in such a supersaturated solution, crystallization at once begins, proceeding rapidly until the concentration is reduced to that corresponding to normal saturation at the temperature at which the experiment is performed. Pressure appears to influence the solubility of a substance to a measurable extent, but the effect of a change of temperature is, in general, far more marked.

A solution which is far from being saturated, by reason of the solvent being present in great excess, is said to be «dilute.» The physical phenomena manifested by dilute solutions are much more simple than those of solutions that are nearly saturated, in precisely the same way that the phenomena exhibited by an attenuated gas are simpler than those exhibited by the same gas in a strongly compressed state.

A solution which is not homogeneous throughout with respect to concentration, but which is dilute in some places and approximates to saturation in others, tends to become of uniform concentration throughout, by a process known as «diffusion.» This consists in the gradual passage of the dissolved solid away from those regions in which the concentration is greatest, and toward those in which it is least. This tendency was first discovered by Parrot, in 1815. It was experimentally investigated by Graham (1850), so far as concerns its manifestation in solutions whose internal motions are not restricted in any way; and Fick, in 1855, gave the fundamental mathematical theory of the process. In Fick's theory, it was assumed that the quantity of dissolved salt which diffuses across a given sectional area of the solution in a given time is proportional to the rate of variation of the concentration of the solution, per unit of length of the straight line that is perpendicular to the sectional area under consideration. This is entirely analogous to the assumption made by Fourier with regard to the conduction of heat through a solid; and therefore Fick was able to apply the results of Fourier's powerful analysis directly to the problem of diffusion in liquids. The subject being essentially mathematical in nature, reference must be made, for further particulars, to the works cited at the end of this article.

It was known in the 18th century that if a glass vessel is filled with alcohol, and the opening is tightly covered with a bladder, and the whole is then immersed in water, the contents of the vessel increase so that the bladder is distended and sometimes burst. This is evidently due to the fact that water enters the closed glass vessel by passing through the more or less porous bladder. In other words, it is a diffusion phenomenon, which takes place between two parts of non-homogeneous fluid system, which are separated from each other by means of a partially permeable partition. The systematic study of diffusion phenomena of this kind has led to many interesting and important results. Pfeffer (1877), by improving upon a suggestion due to Traube (1867), prepared diaphragms that were far superior to the bladders used by earlier experimenters; his method consisting in forming a precipitate of ferrocyanide of copper within the pores of a cell of porous earthenware. The earthenware, as thus prepared, was rendered «semi-permeable,» inasmuch as it would allow of the passage of water through itself, while it would not permit of the passage of any dissolved substance that the water might contain. The porous cell, as thus prepared, was filled with a solution of some substance such as sugar or nitre, and was then carefully sealed up, save for one small opening to which a delicate mercury manometer was attached. The prepared cell being then immersed in a vessel of pure water, it was found that water will enter the cell, until the mercury manometer registers a very considerable pressure;— a pressure of three atmospheres being observed in the case of a 1½ per cent solution of nitre. The passage of a liquid in this manner through a membrane or other porous septum is called osmosis (q.v.), and the pressure observed by Pfeffer is called the «osmotic pressure» of the solution. The osmotic pressure produced by any given solution is found to be proportional to the concentration of the solution, this relation being surprisingly accurate so long as the solution does not approach too closely to saturation. The osmotic pressure is further found to vary with the temperature of the solution; and the remarkable fact has been brought to light, partly by experiment and partly by theory, that for any given solution of constant concentration, the osmotic pressure is approximately proportional to the absolute temperature. De Vries has also shown that for non-electrolytes (such as solutions of sugar or glycerine in pure water), solutions of different substances possess the same osmotic pressures, provided their temperatures are the same, and they contain the same number of gram-molecules of dissolved substance per unit mass of the solvent. (A «gram-molecule» of any substance is a quantity such that its weight, in grams, is numerically equal to the molecular weight of the substance.) It is evident, therefore, that the osmotic pressure of a dilute solution follows laws that are closely analogous to those that hold true for attenuated gases. Much of the modern theory of solutions has been built up on this fact; and while some of the reasoning, by which students of physical chemistry draw upon the known facts of gaseous thermodynamics for information concerning solutions, appears to

Digitized by Google

be more or less imperfect, it must be admitted that the known analogies between attenuated gases and dilute, non-electrolytic solutions are highly interesting and suggestive.

Blagden, in 1788, showed that the freezing point of a salt solution is lower than that of pure water by an amount which is nearly proportional to the concentration of the solution, so long as the solution does not approach too nearly to saturation. Other investigators have examined this subject from time to time, and especially Raoult (1882), who worked with many different solutes, and with several solvents. Raoult's general conclusion was, that in any given solvent, the freezing point (q.v.) is lowered by the same amount, by the presence of one gram-molecule of any dissolved substance whatever. This law is somewhat too general, as it has exceptions which cannot be here discussed; but it is sufficiently general and sufficiently accurate to be of material service in the determination of the molecular weights of substances whose percentage compositions are known by other methods. Raoult found also that the boiling point (q.v.) of a solvent is raised by the presence of a dissolved substance, the elevation being here also proportional to the concentration of the solution, and being, for any one solvent, independent of the nature of the solute, so long as the same number of gram-molecules of the solute are present in every case. This law is also liable to exceptions; but, like the freezing point law, it is very useful. In the determination of molecular weights by either of these methods, it must be remembered that the molecular weight of a substance may be (and indeed often is) different when the substance is considered in different physical states. Beckmann, for example, found that the boiling point of carbon disulphide is raised by sulphur by an amount which indicates that the molecule of sulphur contains eight atoms, when that element is dissolved in carbon disulphide; previous experiments on the vapor density of sulphur indicating that in the vaporous condition its molecule contains six atoms.

In a general way, the ultimate nature of the process of solution is explained by the molecular theory of matter (see MOLECULAR THEORY); but the molecular theory still leaves much to be desired on this score. We are to think of the solid solute as composed of a system of molecules, held together by the inter-molecular attractive forces that cause the parts of solids to cohere to one another. When the solute is placed in the solvent, the external attractive force of the solvent upon the superficial molecular layers of the solute partially neutralizes the internal forces by which these molecules are held in position, and more or less of the molecules of the solid escape into the solvent. As the concentration of the solution increases, an increasing number of the dissolved molecules will again come within the range of attraction of the undissolved portion of the solute, in such a way as to be caught by the solute, and temporarily retained as a part of it. Saturation occurs when the number of molecules regained by the solute in this way in any given time becomes equal to the number lost by it in the same time. Saturation being thus determined by the equality of the molecular exchanges that take place in a given time at the surface of the undissolved solute, it is evident that when no free solid is present, there can be no such equality of exchanges. Hence the possibility of a «supersaturated» solution. Indefinite supersaturation cannot be experimentally realized, however, for in the ceaseless re-arrangement of molecules that takes place in a liquid, it occasionally happens that a certain number of molecules of the dissolved substance fortuitously come together in such a way as to serve as a nucleus for the deposition of the solid; and when this occurs, the supersaturated solution spontaneously deposits the excess of solute that it contains.

The molecular condition of the dissolved portion of the solute has been made the subject of much study. When a solute dissolves, its dissolution is almost invariably accompanied by thermal changes, the solution becoming either cooled or heated. By reason of these thermal changes, the phenomena of solutions may be discussed by the aid of the general laws of thermodynamics (q.v.), without making any special hypotheses as to the ultimate molecular nature of the solution. This plan was carried out with great power by Gibbs, in his celebrated paper entitled 'On the Equilibrium of Heterogeneous Substances' (Transactions of the Connecticut Academy of Sciences, October 1875). His paper is so exceedingly general, and so entirely mathematical, that it is very difficult to read; and hence his methods are not understood, even yet, as widely as they should be. Van't Hoff and Arrhenius, attracted more to the purely physical side of the question, and desiring to form (if possible) some sort of a mental image of the actual processes that are going on, have developed a theory regarding the nature of the dissolved solute, which is known as the «ionic theory,» or as the «electrolytic dissociation theory»; and it is this theory which is most widely accepted at the present time. It has at least the merit of being suggestive, as well as fruitful in practical results. There is also a so-called «hydrate theory» of solutions, in which the solute, in aqueous solutions, is supposed to form a series of definite hydrates with the solvent; analogous compounds being also formed in non-aqueous solutions. This theory has had many distinguished supporters, among whom the great Russian chemist Mendeléeff (q.v.) may be specially mentioned. In recent years its most devoted apostle is perhaps S. U. Pickering, who has defended it with ingenuity and power. The literature of the hydrate theory is not extensive, however, when compared with that of the ionic theory; and the ionic theory has the decided preference among physical chemists, at the present time. A general presentation of the hydrate theory, written by Mr. Pickering, will be found in Watts' 'Dictionary of Chemistry,' article 'Solutions II.'

According to the ionic theory of Van't Hoff and Arrhenius, the solute, in a solution, is dissociated more or less completely into little bodies called «ions»; the dissociation being slight or even zero in some cases, and very extensive in others. In a solution (such as that of sugar in water) which does not conduct electricity electrolytically, there is little or no «ionization,» or dissociation of the solute molecules into ions; while in a solution of a salt, which does conduct electrolytically, the dissociation is large, and

Digitized by Google

may even be almost complete, when the solution is very dilute. The ions are not necessarily identical with the atoms, although they may be so in certain cases. When sulphuric acid and water compose the solution, the sulphuric acid is supposed to be partially dissociated into hydrogen and "sulphion" (SO_4); sulphion being a hypothetical "ion," supposed to be present in the solution, but being admittedly incapable of existence in the free state. In the same way, sodium chloride, NaCl, when dissolved, is supposed to be more or less completely dissociated into the ions Na and Cl. It will be observed, however, that the ions are here *atoms* of sodium and chlorine, and not *molecules;* the molecules of these substances having the respective formulæ Na_2 and Cl_2, and being therefore composed, in each case, of two ions joined together. Here, as in the case of sulphion, the ions are seen to be incapable of free existence; because when the sodium and the chlorine are set free, by electrolysis (q.v.) or otherwise, it is a *molecular* aggregate that is obtained, and not a collection of the free ions. The completeness of the ionization of a solute is affected by various circumstances, but most notably by the degree of concentration of the solution; and the proportion of the solute molecules that are dissociated in any given solution may be numerically determined by various methods, for which the special works on solutions must be consulted. It is important to observe that ions are entirely different things from "electrons," the electrons being the ultimate particles of which the atoms are supposed to be built up, while the ions are either the atoms themselves, or else larger systems composed of the atoms. (See ELECTRON.) The dissociated ions in a solution are supposed to be endowed with electric charges, the two ions into which any given molecule is separated being charged oppositely. In the case of sodium chloride, for example, the sodium ion is charged positively, and the chlorine ion negatively. Upon the evaporation of the solvent, these ions recombine, their electric charges then neutralizing each other, so that the molecule, as a whole, is not electrified. There is no immediate evidence, in a solution, of the existence, within it, of electrified particles, or "ions"; but if an electrical stress is excited across the solution, by inserting the electrodes of a galvanic battery at opposite sides of the containing vessel, the positively electrified ions are urged one way, and the negatively electrified ones the other way. Eventually the ions, thus urged along, come in contact with the electrodes themselves, and here the ions discharge their electricities, becoming thereby capable of existing in the free state again, and being, in fact, deposited upon the electrodes, unless prevented by some secondary action within the cell. It will be observed that electrical conduction through an electrolyte is entirely different (according to the ionic theory) from conduction through solid conductors like metallic wires. The ions in a solution transport their charges bodily, and pour them out upon the electrodes. The charge of an ion is supposed to be perfectly definite in magnitude; and hence Faraday's law, that electrolytic decomposition is accurately proportional to the total quantity of electricity passing through the electrolyte, is easily understood. It might be even better to state it in the inverse form; namely, that the quantity of electricity conveyed across an electrolytic solution, under a given electric stress, is accurately proportional to the total quantity of matter set free upon the electrodes. In a solution which does not conduct electricity, the reason that it does not conduct is supposed to be, that the molecules of the solute are not dissociated into ions to any important extent, so that they are incapable of being electrically charged, and are therefore incapable of acting as conveyors of electricity.

A single example may be given, of the application of the molecular theory of solutions to the explanation of chemical equilibrium, and mass action. Suppose that m gram-molecules of ethyl alcohol, 1 gram-molecule of acetic acid, and n gram-molecules of water are mixed, and the solution is allowed to stand indefinitely. The acetic acid $H.C_2H_3O_2$, combines with the alcohol, $C_2H_5.OH$, to form ethyl acetate, $C_2H_5.C_2H_3O_2$, and water, H_2O, in accordance with the equation: $H.C_2H_3O_2 + C_2H_5.OH = C_2H_5.C_2H_3O_2 + H_2O$. But the reaction proceeds very slowly, so that several days elapse before a state of approximate equilibrium is attained; and even then the solution will contain free acetic acid and free alcohol, the amounts of these that remain uncombined depending upon the relative quantities of the several constituents that were present in the original solution; — that is, upon m and n. (It is this dependence upon the relative quantities of the reacting substances that is understood when we speak of the "effect of mass" in chemical reactions; or, more briefly, of "mass action.") Suppose, now, that after a certain time, there have been x gram-molecules of ethyl acetate formed in the course of the reaction. This implies that there have also been x gram-molecules of water formed at the same time, and x gram-molecules, each of acetic acid and of alcohol destroyed. At the instant contemplated, the number of gram-molecules of each of the several substances present in the solution will therefore be as follows: Of alcohol, $(m-x)$; of acetic acid, $(1-x)$; of ethyl acetate, x; and of water, $(n+x)$. The number of actual molecules of alcohol and of acetic acid present in the solution at this time will therefore be proportional to $(m-x)$ and to $(1-x)$, respectively; and hence the number of chance encounters, during one second, between a molecule of acetic acid and one of alcohol will be proportional to the product of these quantities, or to $(m-x)(1-x)$. We may assume that the number of actual combinations taking place under these circumstances will be proportional to this number of encounters, and to a certain (as yet unknown) coefficient of "affinity," between the two substances, which coefficient we will denote by k. The total number of gram-molecules of ethyl acetate formed during the next following second may therefore be taken as $k(m-x)(1-x)$. Now if we had started our experiment by mixing ethyl acetate with pure water, we should have found that the water and the ethyl acetate would combine to form alcohol and free acetic acid, as indicated by reading the foregoing chemical equation from right to left; the reaction, in that case also, proceeding only to a definite point, and then ceasing. In the actual case we must conceive of both of these reactions as going on simultaneously. There being x gram-molecules of

Digitized by Google

ethyl acetate present at the proposed instant, and $(n+x)$ gram-molecules of water, and the "chemical affinity" of water for ethyl acetate being supposed to be measured by a new coefficient, k', we conclude, by a process of reasoning entirely analogous to that just explained, that in the next following second the number of gram-molecules of ethyl acetate that will be decomposed will be $k^1(n+x)x$. When equilibrium is finally established, so that ethyl acetate is no longer formed or decomposed (that is, when it is formed and decomposed with equal rapidity), we have the equation $k(m-x)(1-x)=k'(n+x)x$. By trying the experiment with known initial quantities of acetic acid, alcohol and water, we could ascertain, directly, the value of x, which now represents the number of gram-molecules of ethyl acetate present when equilibrium is attained; and substitution in the foregoing equation would then give us the ratio of k to k', — that is, it would give us the ratio of the actual chemical affinities that are involved in this reaction. It has been found, in this way, that if we make (initially) $m=1$ and $n=0$, then when equilibrium is attained, the resulting value of x is $2/3$. Substituting this for x, and putting 1 for m and 0 for n, we easily find that $k/k'=4$. With this value of the ratio of k to k', we may write the foregoing equation in the form $3x^2-(4+4m+n)x+4m=0$. This is a quadratic equation, and in order to find the final state of equilibrium for any proportion of alcohol and water to acetic acid in the original solution, we have merely to substitute for m and n their values as given for the primitive solution, and then solve for x. The equation, being a quadratic, has two roots; but no trouble need be had on that account, since it is plain that we must accept that root which would give $x=0$ when we set $m=0$. The results obtained from this equation by calculation have been compared with the direct results of experiment, and the agreement has been found to be quite satisfactory. Many other similar problems have also been worked out from theoretical principles, and the results verified by direct observation; and by the introduction of the methods of the differential and integral calculus it has even been found to be possible to follow the course of such reactions from stage to stage, so that the composition of the solution can be known at every instant, and not merely for the state of final equilibrium.

Consult: Ostwald, 'Solutions'; Whetham, 'Solution and Electrolysis'; Nernst, 'Theoretical Chemistry'; Lehfeldt, 'Text-book of Physical Chemistry'; Jones, 'The Freezing-Point, Boiling-Point, and Conductivity Methods.'

A. D. Risteen, Ph.D.,
Editorial Staff, 'Encyclopedia Americana.'

Solway Firth, sŏl'wā fērth, Great Britain, an arm of the Irish Sea separating the county of Cumberland, England, from the southwestern part of Scotland. It extends nearly 40 miles inland, narrowing gradually from a breadth of 20 miles. Its upper part forms the estuary of the Esk. Large areas are left dry at low tide, while the high tide rushes in as a violent bore.

Solyman I., sŏl'ĭ-mạn, or **Suleiman**, soo-lā-män' (The Noble), emperor of Turkey, son of Bajazet I. After the defeat and capture of his father by Timour at the battle of Angora in 1402 he ascended the throne at Adrianople. In 1410 his subjects revolted, he was dethroned by his brother Mousa, and was shortly afterward slain. He is not regarded by Ottoman historians as a sultan since he governed a part only of the empire.

Solyman II., El Kanouni (The Magnificent), emperor of Turkey, son of Selim I.: b. 1493; d. Szigeth, Hungary, 1566. He succeeded his father in 1520, crushed a rebellion in Syria in 1521, concluded a treaty of peace with Venice and then inaugurated the first of a long series of wars against Europe. He captured Belgrade in 1521, Rhodes in 1522, defeated the Hungarians with fearful loss at Mohács in 1526 and mastered Buda in 1529. He then laid siege to Vienna, but met with disastrous defeat. He took Bagdad in 1534, and on condition of an enormous yearly tribute, concluded a peace with Venice in 1539 and with Austria in 1547. He made successful war against Kurdistan, conquered Van and Tebriz, and part of Georgia in 1548, but in the next year met with continued losses at the hands of Austria, and in 1552 he was defeated with enormous loss in the siege of Erlau. His wars with Persia in 1554–5 were disastrous as were also his Hungarian wars of 1558. He attempted to break Spain's naval power, but met with defeat at Malta in 1565, though he took the Isle of Chios in 1566. He was engaged in a war with Austria when he fell at the siege of Szigeth. His reign saw the zenith and the decline of Ottoman power. He remodeled the code of laws, introduced reforms in the judiciary and in taxation, and erected mosques and public buildings which are marvels of Ottoman architecture. He was also a poet and a patron of literature and art. In addition to his own superior abilities he was aided by statesmen, generals, and naval commanders of unquestionable greatness. His successes came principally in the early years of his reign and though he left his empire with greatly extended boundaries it had been much weakened by his long continued wars.

Solyman III., Turkish emperor, son of Sultan Ibrahim: b. 1642; d. Constantinople, Turkey, 1691. He succeeded to the throne on the deposition of his brother Mahomet IV., in 1687. His life had been spent in the seraglio in the study of the Koran and feeling his incapacity to reign he entrusted the administration of the government principally to his grand vizier Kupruli Zadek Mustapha Pasha, the Virtuous. His reign saw the defeat of Turkish arms in Hungary and in Servia, the grand vizier meeting death at the disastrous defeat of Selankemen two months after the death of his master.

Soma, a sacred plant of India, and an intoxicating drink prepared from it, the latter being a libation of great importance in the ancient religion of India. The draught is not only an offering to Indra, but in the form haoma is poured upon the ground, at the beginning of a meal, or at the reception of guests, as a drink-offering to the earth. Soma is also a lunar divinity, allied to Indra, the plant having been deified before the separation of the Indo-Iranians, on account of its moon-like swelling and color, and because of the maddening effects of its juice. It is, moreover, identified with the Hindus' mythical tree of life that grew in paradise,

Digitized by Google

the juice of which imparted immortality, and which was guarded by spirits. The Rig-Veda refers to this in a hymn:

> We've quaffed the soma bright
> And are immortal grown,
> We've entered into light,
> And all the gods have known.

According to John Fiske, the soma is a plant, connected mythically with lightning. Although several plants have been called soma, it is generally supposed that *Sarcostemma* (*Asclepias*) *acidum* is the plant indicated. It is a climbing plant, also called moon-plant, of the milk-weed family, with slender jointed stems and succulent pendulous branches, terminated by small umbel-like cymes of whitish fragrant blossoms. It has a milky juice. Soma is picked by moonlight, taken to a place of sacrifice, and crushed between stones; the juice is then strained and allowed to ferment. It is then offered to the gods, and afterward drunk by the priests.

Somaliland, sō-mä'lē-lănd, Africa, a general name applied to the coast region to the southeast of Abyssinia, and bordering on the Gulf of Aden and the Indian Ocean as far south as the Equator. The region is divided between France, Great Britain, and Italy. French Somaliland, the smallest, has an area of about 46,000 square miles. It extends from the Strait of Bab-el-Mandeb southward around the Gulf of Tajura, being bounded on the north by the Italian colony of Eritrea, on the west by Abyssinia, and on the south by British Somaliland. The coast is arid, but there are some fertile stretches in the interior. The possession grew from the port of Obok as a nucleus. The present capital is Jibuti, which is becoming an important shipping station. The population of the territory is about 22,000. For the British possessions see British Somaliland. Italian Somaliland is the largest in area, and extends from the Gulf of Aden to the Juba River, which separates it from British East Africa. It stretches 1,000 miles from north to south, and extends from the coast 200 miles inland to the Abyssinian boundary. This region has been but little explored. It rises from the coast in terraced plateaus, which are cut transversely by several fertile river valleys, though the bulk of the land seems to be arid. Arabs inhabit the coast, while Somali and other tribes live in the interior. The chief towns on the coast are Mogadishu and Obbia. The Italian government established a protectorate over the territory by treaties with the native sultans in 1889, with England in 1891, and with the Sultan of Zanzibar in 1892. The immediate control of the chief commercial region is ceded to the Benadir Company of Milan. The chief exports are ivory, cotton, gum and cattle products.

Sombrerete, sōm-brā-rā'tē, Mexico, in the state of Zacatecas, 65 miles northwest of the town of that name, in a mountainous district (2,570 metres), rich in silver. Its mines are said to have once contained the richest veins ever known, but are now nearly exhausted. Pop. 9,700.

Sombrero (sōm-brā'rō) **Island,** West Indies, a small rocky island of the Leeward Group, about midway between the Virgin Group and Anguilla, resembling in form the Mexican hat or sombrero, whence the name. Its staple products are sugar and molasses, besides pineapples and cocoa. It exported formerly large quantities of phosphate of lime, the deposits of which have been exhausted.

Somers, sŭm'ĕrz, Sir **George,** English navigator: b. Lyme Regis, Dorset, 1554; d. Bermuda Islands, 9 Nov. 1611. He took part in a number of voyages, notably in those of Sir Walter Raleigh, upon the Spanish seas, and in 1606 entered into organization of the London or South-Virginia Company for the colonization of the western continent, and was afterward created admiral of the fleet bound for Virginia which sailed from Plymouth, 2 June 1609. His ship, the Sea Venture was separated from the rest of the fleet by a hurricane when half way across the Atlantic, and on the 25th of July, landed at the Bermuda Islands, which were immediately claimed by him as English possessions and named Virgineola, and later the Somers Islands. They were afterward colonized from Virginia. Consult: Williams, 'Historical and Statistical Account of the Bermudas,' p. 16; Neill, 'Virginia Company of London'; Doyle, 'English Colonies in America'; Lefroy, 'Historye of the Bermudaes or Summer Islands' (Hakluyt Soc. 1882).

Somers, John, Lord, English statesman: b. Worcester 4 March 1652; d. London 26 April 1716. He was graduated from Oxford, and admitted to the bar in 1696. As a prominent member of the Whig or Country party, he was active in the political life of the revolutionary period, was engaged as counsel for the Seven Bishops in 1688, and occupied a number of important offices during the reigns of James II. and William III. His valuable papers were collected and edited by Sir Walter Scott in 1809–15.

Somers, Richard, American naval officer: b. Egg Harbor, N. J., 1778; d. 4 Sept. 1804. He entered the navy in 1798 and was assigned to the frigate United States. In the war with Tripoli he was placed in command of the Nautilus, and for gallant service rendered in that campaign was made commander. He was killed in a heroic attempt to destroy the Turkish fleet by blowing up his own ship, the Intrepid, in its midst.

Somers Islands. See Bermuda Islands.

Somerset, sŭm'ĕr-sĕt, Lady **Henry (Isabel),** English temperance reformer, daughter of the Earl of Somers. She was married to Lord Henry Somerset in 1873, is actively interested in various industrial institutions and local missions, founded the industrial farm colony for inebriate women at Duxhurst, Surrey, is president of the National British Women's Temperance Association, and in 1889 was president of the World's Women's Christian Temperance Union. She is editor of the 'Women's Signal' and has written 'Studies in Black and White'; 'Our Village Life,' etc. She has frequently visited and lectured in the United States.

Somerset House, a notable building in London, England, fronting both on the Strand and on the Thames Embankment. It stands on the site of a palace commenced by the Protector Somerset, which, after being the residence of several royal personages, made way for the present buildings. It contains the offices of the registrar-general of births, deaths, and marriages, the exchequer and audit departments, the inland revenue, and the probate and divorce registries of the High Court of Justice.

Digitized by Google

Somerset (Ky.), **Engagement at.** In March 1863, Gen. John Pegram, with 1,550 cavalry and three guns, started from East Tennessee, on an expedition into eastern Kentucky, to seize beef cattle for the Confederate army. On 22 March he crossed to the north bank of the Cumberland River, by Stigall's Ferry, and making a forced march, reached and attacked Danville, on the 24th, driving out Wolford's Union cavalry, and pursuing them nearly to the Kentucky River. He then began to collect his cattle in the counties of Lincoln, Boyle, and Garrard. On the 26th Gen. Burnside ordered Gens. Gillmore and Manson, who were north of the Kentucky River, to concentrate their forces and attack Pegram, then in the vicinity of Danville. Gillmore crossed the Kentucky River at Hickman's bridge on the 28th, and drove Pegram across Dick's River, Pegram burning the bridges to cneck pursuit. On the same day Manson occupied Danville and moved to co-operate with Gillmore, who was following Pegram toward the Cumberland. Pegram had called in and concentrated his command, and falling back skirmishing, made a stand in a strong position, on Dutton's Hill, three miles north of Somerset, in order to check the Union pursuit until he could get all his captured cattle across the river, six miles in his rear. Gillmore, with 1,250 mounted men and six guns, advanced on Pegram's position at daybreak of the 30th and drove his rearguard back upon his main line, which he found strongly posted, and resisting firmly. An effort by Pegram to turn Gilmore's right failed, and Gillmore, dismounting his men and forming in line, the action began at noon by artillery-firing on both sides, which was continued two hours, when Gillmore's men charged to within 30 yards of the Confederate line, and it gave way from right to left, and could not be rallied, until near the town, when order was restored and another position taken and slight works thrown up, about three miles south of Somerset. As night was setting in, no attack was made on this position, Gillmore contenting himself with throwing a few shells and advancing his skirmishers. During the night Pegram recrossed the Cumberland at Stigall's Ferry with 537 of the 750 cattle he had collected. The Union loss in the engagement was about 30 killed and wounded. Pegram reports a loss during his raid of over 200 men. Consult 'Official Records,' Vol. XXIII.

E. A. Carman.

Somerville, sŭm'ẽr-vĭl, **Mary Fairfax,** English mathematician: b. Jedburgh, Scotland, 26 Dec. 1780; d. Naples, Italy, 29 Nov. 1872. She was the daughter of Admiral Fairfax and in 1804 was married to Samuel Grey, who died 1807. Her interest in scientific knowledge was awakened in the course of her early education, when, having learned something of astronomy, there was developed in her a love of the mathematical sciences which she was able to indulge in secret only, but which laid the foundation for her later achievements. It was not, however, until after her 30th year and her marriage to her cousin, William Somerville, that she began to publish the results of her labors. In 1827 she began the translation of Laplace's 'Méchanique Céleste,' and four years later popularized in England the great work of the astronomer under the title, 'The Mechanism of the Heavens' (1831). The book was immediately adopted by the English universities and brought her prominently before the scientific world. Her fame, however, did not rest upon this great undertaking alone. In 1834 she published 'The Connection of the Physical Sciences,' a work which was also widely read, and in 1848 a treatise upon physical geography, which brought her still greater fame. The latter half of her life was spent in Italy, where she lived with her children after the death of her husband, and where her efforts were devoted to the revision of her earlier books, and the writing of her 'Molecular and Microscopic Sciences' (1869). The story of her life contained in an autobiographical account entitled 'Personal Recollections of Mary Somerville,' compiled and edited by her daughter, is a valuable history of her long and useful career.

Somerville, William, English poet: b. Edstone, Warwickshire, 1677; d. 19 July 1742. His most celebrated poem, 'The Chase,' an epic, written in blank verse and published in two volumes in 1734, made a place for him among the 18th century poets.

Somerville, Mass., city in Middlesex County; on the Mystic River, and on the Fitchburg and the Boston & Maine R.R.'s. The Mystic separates the city from Chelsea, on the east, Boston is on the southeast boundary, and Cambridge on the southwest and west. Several steam railroads and electric lines connect the city with Boston, Cambridge, Chelsea, Newton and all the nearby towns and cities. It is largely a residential suburb of Boston, and has many fine private and public dwellings. Somerville was settled in 1629 and was a part of Charleston until 1842 when it was set off as an independent town. In 1872 it was incorporated as a city. It is built on seven hills, all of which exist although street grading has lowered some of them. In 1631 the first vessel built in Massachusetts was launched from Governor Winthrop's «Ten Hill» farm on the Mystic. On Quarry Hill, in the centre of one of the public parks, is an old building, once a powder house, which was built in 1703. During the Revolutionary period several fortifications were built on the hills of Somerville. On Cobble Hill was General Putnam's fortress; another fortification was on Winter Hill; and the «citadel,» on Prospect Hill, was where, on 1 Jan. 1776, Washington raised the first colonial union flag. The city has a large amount of manufacturing interests. The Government census of 1900 gives the number of manufacturing establishments 378, representing 71 industries. The combined capital invested was $10,131,596, and the annual amount paid for raw material was $17,346,772. There were 4,636 persons employed, and the annual wages amounted to $2,466,409. The value of the yearly output was $21,776,511. There are three public parks, a hospital, a Home for the Aged, in charge of the Little Sisters of the Poor, an insane asylum, and a number of charitable organizations. There are 31 churches and 28 school buildings. The educational institutions are English and Latin high schools, public and parish schools, several private business schools, and a public library. In educational and industrial life Somerville is identified with Boston in many ways; but the municipal governments are entirely distinct. Pop. (1890) 40,152; (1900) 61,643; (1910) 77,236.

Somerville, N. J., town in Somerset County; on the Raritan River, and on the Cen-

Digitized by Google

tral Railroad of New Jersey; about 25 miles, in direct line, southwest of Newark and 11 miles west-northwest of New Brunswick. It was founded in 1665, and until 1809 was a part of Raritan. Somerville and vicinity was a camping ground for the American forces during the Revolution. It is in an agricultural region, but it has considerable manufacturing interests. The chief industrial establishments are woolen mills, agricultural implement works, and a shirt factory. There are seven churches, a high school, elementary graded schools, a Baptist classical school, and a public library, founded in 1871. The two national banks have a combined capital of $142,340; there is also a savings bank. Pop. (1910) 5,060.

Sometsuki (sŭm-ĕt-soo'kē) **Ware,** the name given in Japan to a species of porcelain decorated under the glaze with ornaments in a blue pigment obtained from cobalt ore. It is made chiefly for domestic use. See PORCELAIN.

Somme, sŏm, France, (1) A river rising in the department of Aisne, seven miles northeast of Saint Quentin, flowing from southeast to northwest and falling into the English Channel. Its chief affluents are the Avre and Celle. It is 135 miles long, and navigable from Amiens as far as Abbeville (q.v.) for vessels of 300 tons. It has canal connection with the Oise and the Scheldt. (2) The department of Somme in northern France has an area of 2,378 square miles. It consists of highly cultivated and large, fertile plains, and its highest point is at the southwest. Considerable land beyond the sand dunes of the coast has been reclaimed. The river Somme is the principal stream, and on it is situated Amiens, the chief town. There are numerous industrial works — foundries, mills for textiles, paper, chemical, soap, lock, beet-sugar and other factories; important fisheries, etc. The exports include raw materials for manufacture, cider, timber, dyes, coal, horses and cattle. It is traversed by several railways.

Sommerville, sŭm'ẽr-vĭl, **Maxwell,** American archæologist: b. Philadelphia 1 May 1829; d. Paris, France, 6 May 1904. Having spent many years in the collection of precious stones and historical gems, he became an authority upon glyptography and allied subjects, and in 1894 was appointed professor of glyptology in the University of Pennsylvania. He is the author of 'Engraved Gems'; 'Sands of Sahara' (1901), a monograph entitled 'A Buddhist Temple' (1900), and other works.

Somnam'bulism (sleep-walking, also sometimes called noctambulism), pathologically considered, is caused by a disordered condition during sleep, analogous to the hypnotic or mesmeric state; a condition of the brain which impels a sleeping person to perform unconsciously acts that naturally belong to the waking state. It is similar to somniloquy or sleep-talking. Hippocrates, Aristotle, and other ancient authors wrote upon it, and Galen is said to have been a victim to it. «The mind acts automatically under the dominance of some single idea. Sight, hearing, and nearly all the avenues of sense are closed. The sleep-walker avoids obstacles and performs ordinary acts automatically, like an absent-minded man, which in reality he is.» His train of thought is in accordance with his single idea, continuous and logical. Portions of the brain usually involved in the physiological conditions peculiar to sleep seem to be exempt. The sleeper exerts powers which sleep usually annuls; the direction of voluntary movements in most trying circumstances is marvelous; he may be quite deaf to all ordinary auditory impressions; his eyes are usually insensible to light; they may be closed, partly closed, or wide open; the pupils may be widely dilated, contracted, or normal. The somnambulist has been known to walk from one part of the house to another, to climb steep roofs or walk along their ridges with ease, to solve intricate mathematical problems, to write letters or work upon pictures, to attempt murder or suicide, etc. He is roused from this state with difficulty, when he remembers nothing of what has occurred.

Somnambulism seems to be hereditary. It is regarded as the result of a morbid condition, and occurs mainly in neurotic individuals as an effect of violent emotions, nervous sensitiveness, or self-concentration associated with ill health. It often occurs at about the age of puberty. Overeating and sleeping with the head too low are causes. Usually the somnambulist should not be awakened until he is safely back in bed. To remedy the condition, unfavorable environments must be avoided, diet regulated, and ill health relieved principally by hygienic measures, though tonics are of service.

Somnáth, sōm-nät', or **Patan,** a town on a bay of the Arabian Sea, in Gujarat, 210 miles northwest of Bombay, almost enclosed by a massive wall, flanked by 38 towers. Magnificent ruins, of which the great temple may be seen at a long distance, mark its former wealth and prosperity. It was one of the original seats of Siva worship in India, and has recently again become a favorite place of pilgrimage. The town contains many memorials of Krishna, but most of the inhabitants are Moslems, who have erected many mosques. The port of the town is Verâwal. Pop. 10,000.

Som'nus, in Greek mythology, the god of sleep, son of Nox (Night) and twin brother of Mors (Death). He dwelt at the western extremity of the world, where the imagination of early poets placed all awful beings. Some of the poets describe him as a handsome youth, some as a dull and lazy god, whose dark abode no ray of Phœbus enters. He is sometimes represented with a wreath of poppies; sometimes with a horn, in which he carries dreams.

Sonata, sō-nä'tạ, a simple piece of instrumental music intended to express various feelings in different passages, according to the variety of expression of which the instrument is susceptible. The sonata usually begins with an allegro or lively passage, followed by an andante or adagio; then a minuet with a trio, or a scherzo; and lastly a rondo, or presto. Instead of the second, third, or last division, variations are also made use of. The older forms of sonata, the word signifying an instrumental composition as distinguished from cantata, were written in two or more divisions and like the modern sonata constituted a complete musical piece — the passages connected by a common character — and exposition, development, and restatement with a conclusion artistically worked out. The sonata was originally designed for

Digitized by Google

Digitized by Google

Digitized by Google

SONG BIRDS

1. Nightingale. 2 Robin Redbreast. 3. Blackcap. 4 Shrike. 5. Song Thrush. 6. Starling. 7. Chaffinch. 8. Siskin. 9. Goldfinch. 10. Linnet
11. Bulfinch. 12. Grossbill. 13. Skylark. 14. Greater Titmouse. 15. Blue Titmouse.

Digitized by Google

Digitized by Google

one instrument only, principally for the violin; afterward for the piano almost exclusively. Subsequently sonatas or double sonatas were composed in which the piano or harpsichord is accompanied by other instruments; for instance, the violin or flute, horn, clarinet. The expression of the sonata is to be determined by the character of the instrument — a circumstance which modern composers have not sufficiently observed. In sonatas for several instruments the principal instrument is either only assisted (as is the case, for instance, with many sonatas for the pianoforte accompanied by the violoncello), or the instruments alternate, so as to make the sonata a dialogue of instruments. An easy or short sonata is called sonatina. The most distinguished composers of sonatas are Bach, Haydn, Beethoven, Mozart, Mendelssohn, Clementi, Cramer, Hummel, Weber, Moscheles, Kalkbrenner, Field, and Brahms.

Sonderbund, zŏn'dĕr-boont, a league formed in 1846 by seven Roman Catholic cantons of Switzerland against the Federal Diet, which had decreed the expulsion of the Jesuits. The Diet voted the Sonderbund illegal 20 July 1847. Freiburg, their stronghold, was captured 13 November, Lucerne 24 November, and the Sonderbund was dissolved.

Song, a little poem intended to be sung; a lyric. The term is applied to either a short poetical or musical composition, but most frequently to both in union. As a poetical composition a song may be defined as a short poem divided into portions of returning measure, and turning upon some single thought or feeling. See also MUSIC.

Song of Birds. The voice or song of birds results, like that of all higher vertebrates, from the vibration of vocal chords and of a column of air passing through the trachea or windpipe. In birds, however, the organ of voice is double and consists of an upper and a lower larynx or syrinx, the latter being the organ in which the voice or song is actually produced. The upper larynx is partly bony and partly cartilaginous, is situated at the glottis or opening of the trachea into the mouth and is of much simpler structure than the larynx of mammals, lacking the vocal chords. Except in the ostrich, American vultures, and a few other birds, the syrinx is always developed. It presents great variety in size, form, and disposition of parts. Its bony elements consist essentially of modifications of the lower rings of the trachea at the point of its bifurcation to form the bronchi, and may be tracheal alone, or bronchial alone, or combine elements of both bronchi and trachea. The structure of the upper larynx, apart from experimental demonstration, proves that it is incompetent to produce the song-notes; and its chief office must therefore be that of modifying the song. The syrinx of the bird may be compared to «a reed prefixed to a tube.» Its characteristic structure is the semilunar membrane, which is attached to the upper part of the bony structure known as the transversale or pessulus, which bounds the lower end of the windpipe.

This semilunar membrane is in fact one of the vocal chords, but a pair of others are formed from folds of the mucous membrane projecting into the interior from the upper bronchial rings and bounding the pair of syringeal glottis laterally. The great distinction existing between the syrinx of singing and of non-singing birds lies in the mobility of these parts and the arrangement of the muscles. In the true singing birds the latter are numerous, distinct, and so attached as to produce the tensions or laxness of the vocal chords upon which the variety of notes depends.

The song of birds, like the notes of most, if not of all, other animals, is in a minor key. Usually the range of song-notes may be comprised within a single octave, but of course these limits may be, and frequently are, greatly exceeded. The parrots, with a great range of voice, and possessing great vocal capabilities, possess an inferior larynx, which differs from that of most other birds in being single in its nature. In the production of the peculiar shrill whistling of parrots the glottis is probably passive or silent — the column of air vibrating as in a flute, where a vibration is communicated by the air and traverses the elastic walls of the tube. Nearly all singing birds belong to the group *Oscines,* and stand at the head of the class in perfection of general organization.

While much has been written in description of the songs of various species of birds and literature teems with tributes to the ability of feathered songsters, and although many songs have been reduced to words and others written in music, the philosophical side of the subject has been much neglected and a thoroughly comprehensive work is still a desideratum. One fact stands out very clearly, namely, that the vocal efforts of birds bear a close relation to sexual excitement. With many birds true song is confined to the period of mating and incubation and is replaced by the ordinary calls of alarm, etc., very soon after the young have hatched. In almost all it reaches its highest expression during that period and its effect is then heightened by various accompaniments of gesture, peculiar modes of flight, etc. Among true song-birds great vocal powers are almost confined to the males, and are generally supposed to be the expression of greater vitality or to have resulted through selection by the females for their partners of those most gifted. A view which is gaining ground among zoologists is that the distinctive songs of birds are mimetic in origin and some consider that bird language, like human language, is not hereditary, but is learned anew from their parents by the young of each generation. Given an original exclamatory power of expression this has been given direction and augmented by the imitation of the various sounds of inanimate and animate nature, by which various species of birds were surrounded in their particular environment, just as the same elemental influences have been invoked to explain the origin of human language. In sexual selection, in the pleasure derived by a bird from its own music and in the needs for fuller powers of expression are supposed to lie the forces effective in its further development.

Besides general works on ornithology, in which are included detailed descriptions of the songs of particular birds, consult Darwin, 'The Descent of Man,' Vol. II. (New York 1871), and 'Expression of the Emotions' (New York 1873); Witchell, 'Evolution of Bird Song' (New York 1896); Rhoads, 'American Naturalist' (1899); Jones, 'Songs of the Warblers' (Oberlin 1900); Burroughs, 'Century Magazine' (1898–9).

Digitized by Google

Song of Solomon. See CANTICLES OR SONG OF SONGS.

Song-sparrow, a well known sparrow (*Melospiza fasciata*), found in some one or other of its numerous races in all parts of North America except in the extreme north and south on the eastern side. The song-sparrow may be readily recognized by its thickly streaked plumage, brown above, ashy below, with the brown, black-centred streaks coalescing on the breast into a conspicuous spot. In most parts of the East song-sparrows remain throughout the year, but there is nevertheless a distinct north and south movement, the winter birds of any given locality being visitors from the North. In the New England and most parts of the Middle States they are more plentiful in summer than in winter. During the latter season they associate more or less with flocks of fox-sparrows, white-throated sparrows and other species which frequent thickets along water-courses, but are much less gregarious than they. Their food consists of seeds of various kinds and in summer and autumn of insects and berries. They are chiefly birds of the ground and bushes, and are never seen in the high tree-tops. Few birds surpass the song-sparrow in the real melody of their simple song, and few birds require so little of sunshine to start the joyous outburst even in midwinter. They sing in every month of the year, but most persistently and sweetly during the breeding season. The nest, which is built on the ground or in a low bush or evergreen, is a bulky structure of grass, leaves, etc., lined with fine grasses or horse-hair, receives 4 to 5 greenish white eggs varied endlessly in the character of the spots and blotches of browns and lavender. Usually two or three broods are raised each season. Other eastern species of the same genus are the Lincoln's sparrow (*M. lincolnii*) and the swamp-sparrow (*M. georgiana*) while, besides the numerous varieties of the song-sparrow in the West and Southwest, two distinct species (*M. insignis* and *M. cinerea*) occur in Alaska.

Song-thrush, or **Mavis.** See THRUSH.

Sonnenschein, zōn'ĕn-shīn, **William Swan,** English publisher: b. London 5 May 1855. He was educated at University College, London, and began the study of medicine. In 1878 he established a publishing business which since 1895 has been conducted as a limited company, under the name of Swan Sonnenschein & Co., of which he is chairman. He is also joint managing director of George Routledge & Sons, Limited. He has published: 'The Best Books' (1887; 5th impression, 1901), a classified dictionary of about 50,000 of the best available books; and 'A Reader's Guide to Contemporary Literature' (1901), a supplement to the foregoing.

Sonnet, in poetics: (1) A short poem, song, or ballad. (2) Specifically, a short poem of prescribed form, restricted to 14 verses arranged according to a fixed disposition. The word came from the Italian *sonetto,* probably derived from the Old French and Provençal *sonet,* a diminutive of *son,* which was in turn obtained from the Latin *sonus,* a sound or musical air. That the sonnet originated in Italy seems now definitely settled, but the manner of its origin remains an object of discussion. D'Ancona ('Poesia Popolare,' 1878) as the result of his investigations, believes that it was developed by a combination of two popular stanzas, the *strambotto,* of 8 verses, with a riming-scheme *a b a b,* etc., and the *rispetto,* of 6 verses, with a scheme *c d c d,* etc. Cesareo, a later student ('La Poesia Siciliana,' 1894), modifies this view by making the combination one of *strambotti,* the one of 8 verses, the other of 6. The beginnings of the sonnet appear to date from the early 13th century. It quickly attained popularity, and various writers attempted elaborations and other changes. Septisyllabic verses were inserted to vary the hendecasyllabic measure, the length of the sonnet being sometimes thus doubled; or verses might be appended, constituting a *coda* or *cauda.* The simpler arrangement, however, prevailed. At the same time, as to the riming-scheme, in the octave, or portion of 8 verses, the arrangement *a b b a a b b a* replaced that of *a b a b,* etc., while in the sestet, or portion of 6 verses, it might be *c d e c d e,* as well as *c d c d,* etc. The sonnet was firmly established on this new basis by Francesco Petrarca (Petrarch), and this form has since been generally known as the Petrarchan. Wyatt (q.v.) and Surrey (q.v.) introduced the sonnet into English literature in the middle of the 16th century. In England a modification was employed by Shakespeare, Drayton, and others. This modification has been called the simple stanza in contradistinction to the Petrarchan, or compound, stanza. The type is *a b a b a b a b a b a b c c.* The Shakespearian is distinguished in another way from the Petrarchan; for while the latter formally separated the octave and sestet, the former could not properly be said to have such a division — the arrangement being really three quatrains succeeded by a couplet — and the sense therefore might be continuous. In English the decasyllabic measure is the one generally used, although the octosyllabic is found. The Shakespearian type has not been to any extent used, the Petrarchan being regarded as the orthodox or standard. Deviations, as in the case of S. T. Coleridge (q.v.) are called irregular sonnets or quatorzains; or, in Charles Lamb's whimsical coinage, «fourteeners.» Critics point out what is called the Miltonic structure in the Petrarchan sonnet, Milton blending octave and sestet so that there is no pause in rhythm or thought. This modification has by Sharp ('Sonnets of this Century,' 1886) and others been distinguished as a separate type. The sonnet should be the vehicle of expression of one thought, or idea, and the compactness and unity of the verse-form of course favor this. Hence the sonnet has been much used for what Watts-Dunton has styled «poetised didactics.» The difficulties offered by the sonnet are considerable. The sense of mere ingenuity, except in the case of such facetiæ as Milton's 'On the Detraction Which Followed Upon My Writing Certain Treatises' (XI.), is necessarily to be avoided. Even a partial list of sonnet-writers in English would require much space. A collection of British examples, from the Earl of Surrey to Alexander Smith, was made by J. Dennis (1873). American literature has in the sonnets of Longfellow (q.v.), notably the series on the 'Divine Comedy,' many of the finest specimens in the language. Consult, besides the above-mentioned works: De Veyrière, 'Monographie du Sonnet' (1869–70); Tomlin-

Digitized by Google

son, 'The Sonnet' (1874); Welti, 'Geschichte des Sonettes in der deutschen Dichtung' (1884); Gummere, 'Handbook of Poetics' (1885); Main, 'A Treasury of English Sonnets' (1880); Corson, 'A Primer of English Verse' (1892); Noble, 'The Sonnet in England' (1896); Vaganay, 'Le Sonnet en Italie et en France au XVIème Siècle' (1902); Herrick, 'A Century of Sonnets' (1902).

Sonom'eter. See MONOCHORD.

Sonora, sō-nō'rä, Mexico; except Chihuahua, the largest state of that republic; bounded on the north by Arizona and New Mexico (United States), on the east by Chihuahua, on the southeast by Sinaloa, on the southwest and west by the Gulf of California, and on the northwest by the Territory of Lower California. Area, 76,900 square miles. The mountains of the eastern part of the state are the Sierra Madre and a number of secondary chains. Principal rivers are the Altar (also called Asunción or San Ignacio), Yaqui, Mayo, Sonora, and Mátope. The chief port is Guaymas. In the mountains the climate is cool, and occasionally cold; the flat western districts and the low, arid coast are hot, the thermometer sometimes recording 119° F. at Guaymas. In 'Mexico: a Geographical Sketch' (Bureau American Republics, 1900), "rain falling from a cloudless and serene sky," is mentioned as a "peculiarity" of the Sonora coast. The production of minerals in this state is especially noteworthy, the annual exports of silver, lead, gold, copper, coal, antimony, iron, cinnabar, and graphite being valued at 10,000,000 to 12,000,000 *pesos* (value of Mexico silver "dollar" or *peso*, $0.461 on 1 Jan. 1904). The soil is fertile, but in many sections requires, and at present lacks, irrigation. The chief products are cereals, tobacco, cotton, sugarcane, and fruits. Imports are: machinery and agricultural and mining implements, material for clothing (cotton, linen, wool, and silk), wines and liquors, hardware, and arms and ammunition. Some of the pearls found in the Gulf of California are sent to European markets; otherwise all the foreign trade is with the adjacent States and Territories of the American Union. The only railway in the state runs from Guaymas to Nogales. The latter, being on the boundary-line between Sonora and the United States, is divided by a street into the two towns of Nogales, Mexico, and Nogales, Arizona. The capital of the state is Hermosillo (pop. 8,474), chief town of the rich mining district also called Hermosillo. Here are located the government palace, mint, cathedral, and library. Pope Pius VI. in 1779–81 created a bishopric including Sonora, Sinaloa, and the two Californias. In 1842 Gándara, an ambitious provincial leader, made Sonora the theatre of a civil war. During the war with France (1862–7), interesting campaigns were conducted in the state. Hermosillo, captured 4 May 1866 by the republicans, was re-taken by the imperialists; but the French forces were withdrawn from Guaymas in September of the same year. Less than a decade afterward occurred the Yaqui war (1885–6). Total population of the state, 220,553.

MARRION WILCOX,
Authority on Latin-America.

Sons of America. See PATRIOTIC SOCIETIES.

Sons of the American Revolution, a patriotic American society, organized in New York in April 1889. Its objects are to perpetuate the memory and spirit of the men who achieved American independence by the encouragement of historical research in relation to the Revolution; the preservation of documents, records, and relics, and to foster true American patriotism. There are branches of the society in various States. The total membership of the society is about 12,500.

Sons of Liberty, an American patriotic association of the colonists called into existence by Lord Grenville's Stamp Act. They combined to throw off the allegiance to Great Britain and make America independent. The association began in New York and Connecticut. The Sons of Liberty joined the Society of Tammany early in the 19th century. See TAMMANY SOCIETY.

Sons of the Revolution, an American patriotic society organized in New York in 1875 by John Austin Stevens and others. The practical work designed for the society includes the collection and preservation of manuscripts, records, and other documents relating to the War of the Revolution. There are branch societies in various States, including California. The membership in 1910 was 7,560.

Sons of Temperance. See TEMPERANCE, SONS OF.

Sons of Veterans, an American patriotic organization, founded in 1879. There are 27 State organizations and 2,000 local camps, and in 1910 the membership exceeded 100,000. Those eligible to membership are all male descendants, not less than 18 years old, of all soldiers, sailors, or marines, who served with the Union forces in the Civil War.

Sontag, zōn'täg, **Henrietta**, German opera singer: b. Coblentz, Prussia, 13 May 1805; d. Mexico 17 June 1854. She was a favorite of the German operatic stage in her girlhood, and later one of the most celebrated singers of Europe. In 1830 she was married to an Italian nobleman and withdrew from public life and to comparative retirement from the stage. In 1852 her husband's fortunes having been greatly altered by political changes, she made a tour through the United States and won fresh laurels by her voice and dramatic talent, but succumbed to an attack of cholera while singing in Mexico.

Soo Canals. See SAULT SAINTE-MARIE CANALS.

Soot, a very finely-divided carbon, deposited from the smoke of burning substances. Lampblack is a soot usually prepared by igniting resin or pitch, leading the smoke and vapor through an iron tube, where the oily products condense, and then into a series of chambers, in which the carbon is deposited, the purest carbon being found in the chamber farthest from the point of combustion. See also CARBON; LAMPBLACK.

Soothsayer. See MANTIS.

Sooty Tern. See EGG-BIRD.

Sophia, empress of Constantinople, niece of Theodora and wife of Justinus II. She was a beautiful, clever, and ambitious woman, and after the accession of Justinian II. to the throne in 565 was the real ruler of the country. Her

Digitized by Google

husband's successor, Tiberius II., was chosen by her advice, and after the death of Justinus in 578 she planned to become the wife of Tiberius. Finding her designs frustrated she conspired against him, but her plot being discovered, she was deprived of power and compelled to live the remainder of her life in privacy.

Soph'ists, the designation applied to certain schools of philosophers in Greece, which occupied the transition period between the older and ruder cosmical philosophies, and the more refined subsequent systems, which, beginning with Socrates, Plato, and Aristotle, were founded primarily on the study of the human mind as the perceiving, thinking, reasoning, and knowing subject. In the older systems the direct relation of mind to the objective universe did not receive prominent attention. The hypothesis of a unity in the external variety was assumed without dispute, and a theistic or materialistic interpretation of this unity formulated according to the tendency of the school. In this manner arose a succession of systems which were agreed in being artificial cosmogonies, unrelated if not hostile to the current traditions of religion, and however superior to these current notions as the efforts of great minds to comprehend the relations of things, they were still unable to stand the inevitable criticism of comparison with fact. Of this comparison and criticism the sophists were the exponents, and its force fell both on philosophy and religion. But none of the sophists were really great men, at least in comparison with those who succeeded them, and they appeared in an age of political decline and social corruption.

The direct services of the sophists to philosophy appear to have been small and negative. It is too much to attribute to them as a merit the introduction of subjective philosophy. This, as its simultaneous appearance in different schools proves, was no more than a necessity of the period to which they belonged. What chiefly marks the sophists was their incapacity to generalize the subjective element, in consequence of which they were not philosophers properly so called, but only the critics of a dying philosophy. But the sophists rendered to science and literature, and even indirectly to philosophy, much greater services than as philosophers they were able to render to philosophy. They have been not inaptly compared to the French encyclopædists. They belonged to all the liberal professions; they taught all the usual branches of knowledge. Some of them were distinguished as rhetoricians and grammarians, others as men of science. They frequently made a profession of universal knowledge, and though from their overweening estimate of the newly found subjective element of knowledge they carried this pretension so far as to profess to speak of subjects of which they knew nothing, all their pretensions were not equally frivolous. Rhetoric, to which they naturally gave undue importance, was systematically studied by them, and they supplied some of the earliest models of good Greek prose. They are accused, however, particularly the later sophists, of being not only superficial in their attainments, but mercenary, vain-glorious, and self-seeking in their aims.

Protagoras of Abdera, the earliest and one of the most important of the sophists, was contemporary with Socrates, but considerably older; he applied the Heraclitan doctrine of the universal flux of all things to the mind, maintained the uncertainty of the existence of the gods and the relativity of all truth. Man, he said, is the measure of all things. That is true for the individual which for the time being he perceives or feels. Sense and the gratification of sense are the only relations which subsist between man and the external world. All opinions are equally true, and contradictories may be affirmed with equal authority. Protagoras is said to have been the first who taught for pay, and though he left his pupils to fix his remuneration according to the amount of benefit they had received, he is said to have become wealthy. Gorgias of Leontini came to Athens in 427 B.C. as an ambassador from his native city. He affected great pomp, and studied to excel in the splendor of his rhetoric. Founding upon Zeno, he took a bolder stand in skepticism than Protagoras. His book was called 'Of the Non-Existent or of Nature'; and his three cardinal propositions were that nothing exists, that if anything exists it cannot be known, that if it could be known it could not be communicated. Gorgias reaches these conclusions by a logical quibble, in which he plays off Heraclitus against the Eleatic school. The skepticism of Gorgias, however, like that of other sophists, as it was founded on a superficial logic, was neither very profound nor very consistently developed. His successors applied it chiefly in a moral direction, which made Plato call the art of rhetoric as taught by Gorgias a corruption of justice. Hippias of Elis represented the law as a tyrant in compelling men to act contrary to nature. Thrasymachus made the gratification of desire the natural right of the stronger and might the law of nature. Critias, one of the 30 tyrants, ascribed faith in the gods to the invention of politicians. Prodicus of Ceos taught a morality more in accordance with ordinary conceptions of right. Some of his moral discourses are preserved, and are still admired for the feeling they display. His teaching was recommended by Socrates, and he has sometimes been called his predecessor. Prodicus is said to have been exorbitant in his charges for instruction. He taught rhetoric to Euripides.

Sophocles, sŏf'ō-klēz, Greek tragic dramatist, one of the three great tragic writers of Attica: b. deme of Colonus, near Athens, about 495 B.C.; d. 405 B.C. He received the Attic higher education of the time, and 468 B.C. first appeared as a dramatist, when he took the first prize in competition with Æschylus. To this result political causes probably contributed, as the judges belonged to the party to which Æschylus was opposed, and with which Sophocles was in sympathy. Æschylus retired to Sicily, and only returned to enter again for a prief period into the lists with Sophocles. Sophocles accordingly held all but undisputed supremacy until the appearance of Euripides, who took the first prize in 441. Sophocles, however, excelled both his rivals in the number of his triumphs. He took the first prize about 20 times, the second frequently, the third never. In 440 B.C., owing probably to his connection with Pericles, he was chosen one of the ten strategi in the war against the aristocratic party of Samos. He did not pride himself

Digitized by Google

much on military capacity, and appears to have readily deferred to the judgment of others. He was also employed in negotiations with the allies of Chios and Samos, was a general in the Peloponnesian war, in 435 was director of the treasure of the allies, stored on the Acropolis, and in 413 a member of the committee for reporting on the advisability of giving the state an oligarchical constitution. About 130 plays in all are ascribed to Sophocles. Seven are preserved entire. More than 100 are known by titles or fragments. Of the extant dramas the probable chronological order is 'Antigone,' 'Electra,' 'Trachiniæ,' 'Œdipus Tyrannus,' 'Ajax,' 'Philoctetes,' 'Œdipus at Colonos.' Sophocles brought the Greek drama to the highest point of perfection of which that form of art is susceptible. He introduced some important changes in the form of the drama; brought a third actor on the stage, and later even a fourth, two only having previously been allowed to appear at once; and increased the number of the chorus while giving to it a greater subordination to general effect. It tended to the perfection of the drama that Æschylus, Sophocles, and Euripides at once adopted each other's improvements. The dramas of Sophocles were not arranged, like those of Æschylus, by trilogies, but were complete in themselves. He is distinguished by the great skill with which the action of the plot is evolved from the characters. The characters of Sophocles are undoubtedly the most perfect, distinct, and individual that can be drawn, and at the same time arrayed in all the charms of ideal representation. His choruses have always been celebrated as the finest productions of dramatic poetry. No tragic poet in ancient or modern days has written with so much elevation and purity of style. The versification of Sophocles stands alone in dignity and elegance, and his iambics are acknowledged to be the purest and most regular. His religious reverence is always marked. He holds the mean between the somewhat vague sublimity of Æschylus, and the more familiar and rhetorical manner of Euripides. He is a just literary representative of the age of Pericles. (See DRAMA, GREEK LITERATURE.) Among the chief editions are Dindorf (1825); Schneidewin and Nauck (1877–82); and Wolff (1858–65). There is an annotated English edition by Jebb, Vols. I.–V. (1884–95). There are also numerous editions of individual dramas, with English notes. English verse translations exist by Plumptre (1871) and Campbell (1873). Consult also: Kennedy, 'Studia Sophoclea' (1874); Ribbeck, 'Sophokles und seine Tragödien' (1869); Borschke, 'Æschylus und Sophokles' (1872); 'Lichtenstein, 'Shakespeare and Sophocles' (1850); Campbell, 'A Guide to Greek Tragedy' (1891); Moulton, 'The Ancient Classical Drama' (1890); Mahaffy, 'Classical Greek Lit. Dramatic Poets' (1891).

Sophocles, Evangelinus Apostolides, American Greek scholar: b. Tsangaranda, Thessaly, 8 March 1807; d. Cambridge, Mass., 17 Dec. 1883. He was educated at Amherst College. In 1842 he became a tutor in Greek at Harvard, and in 1860 professor of ancient and modern Greek there. His chief work, a 'Greek Lexicon of the Roman and Byzantine Periods,' was published in 1870. He wrote also: a Greek Grammar (1838); 'History of the Greek Alphabet' (1848); 'Glossary of Later and Byzantine Greek' (1860), revised as 'A Greek Lexicon of the Roman and Byzantine Periods' (1870).

Sora, a bird of olive-brown above striped with black and streaked with white, found in marshes of the Atlantic coasts of the United States. See RAIL.

Sorata, sō-rä'tä, or **Illampu,** ēl-yäm'poo, Bolivia, a peak of the Andes, situated in the Cordillera Real northeast of Lake Titicaca. It is an extinct volcanic cone, the highest peak in Bolivia, and one of the highest on the American continent. Its altitude is 21,525 feet, and it towers 8,800 feet above the surrounding plateau.

Sorbonne, sŏr-bŏn, Paris, France, a celebrated college in the Latin Quarter of Paris, founded in the 13th century. It was originally intended for the instruction of secular priests, who would teach gratuitously, and was an innovation among schools, as scholars heretofore were obliged to find lodgings outside the school. The old Sorbonne was exclusively theological, and attained great influence in church and state. Many of the instructors were celebrated doctors;— its school always stood for the most conservative elements in French religious thought. In 1792 its property was converted into other purposes. In 1808 Napoleon reorganized the University of France and as the *Académie de Paris* it embraced, besides theology, the faculties of the exact sciences and belles-lettres.

The historic building which stood from the 13th century to the Revolution of 1792 has been replaced by a fine modern building erected from the plans of M. Nenot, winner of a "Grand Prix de Rome," the front of which, on the side of its official entrance, extends 274 feet along the Rue des Ecoles; then in an irregular oblong of from 700 to more than 800 feet, the building climbs the hill along the Rue St. Jacques. Incorporated in the building is the 17th century church containing the tomb of Cardinal Richelieu, one of the great benefactors of the college. Carved architecturally without and painted murally within, with arched vestibules and a giant stairway and cloistered passages round interior courts, the building has hundreds of lecture-rooms, well fitted to their purpose, and many corners reserved for laboratories.

The modern building, now practically complete, except in details, serves first for the two faculties of letters and sciences of the University. It includes none of the professional scientific schools, but it furnishes a place for the Ecole Pratique des Hautes Etudes — a special school for the supraliminal highest courses of all — and for the celebrated Ecole Nationale des Chartes, where archivists, librarians, and archæologues who have to do with documents may learn to read and weigh the parchments of a thousand years equally with the browning papers of the Revolutionary tribunals and the sources of contemporary French history.

Sorcery. See WITCHCRAFT.

Sordello, sŏr-dĕl'lō, Italian poet: b. near Mantua, Italy, about 1200; d. about 1255. He was one of the most celebrated of the early Italian poets who wrote in the style of the earlier troubadours and in their Provençal language. The story of his life is the subject of

Digitized by Google

Browning's 'Sordello,' and was used by Dante in his 'Divine Comedy.'

Sorel, sō-rĕl, **Albert,** French author: b. Honfleur 13 Aug. 1842; d. 29 June 1906. He was a correspondent of the academies of Cracow, Munich, Copenhagen, Stockholm and Berlin, and of the Royal Historical Society of London; he was licentiate of law, secretary-general to the president of the senate, 1876–1902; president of the upper commission of national archives, and vice-president of the commission of diplomatic archives; and also professor at the free school of political sciences. He wrote 'Diplomatic History of the Franco-Prussian War' (1875); 'Europe and the French Revolution' (1885–91); 'Lectures and Essays on History and Literature' (1882–1901); 'Madame de Staël' (1891).

Sorel, Canada, town and county-seat of Richelieu County, Quebec; on the Richelieu River at its confluence with the St. Lawrence at Lake St. Peter, and on the South Shore and Quebec Southern railways; 45 miles northeast of Montreal. It is built on the site of a 17th century fort, and was formerly called William Henry. It has a good harbor; and is the winter quarters for many of the St. Lawrence River steamboats, and has extensive ship-building and ship-repairing interests and manufactories of mill machinery, engines, ship stores, plows, leather, stoves, brick and tile. flour, and lumber. The trade in grain and farm produce is important. The town is well built, has substantial county and other public buildings, good schools, a number of handsome churches, hotels, banks, and weekly newspapers. Pop. about 8,000.

Sorel River. See RICHELIEU.

Sorghum, sôr'gŭm, an annual cane-like plant (*Andropogon sorghum*), resembling Indian corn in general appearance and habit of growth. The sorghums are without ears, and are distinguished by heavy heads of small seeds which terminate the stalk. (See GRASSES.) The cultivated varieties are usually treated as a distinct species by botanists, but some prefer to consider them as derived from a wild species, *Sorghum halepense*. The sorghums have been known from the remotest periods of history, and their cultivation of sorghum probably had its origin in Africa, where a variety, durra, is cultivated over the whole continent, and is put to a variety of uses; the negroes chew the stem for the sugar, and make alcoholic drinks from the grain. Varieties of sorghum were known in China from a very remote period. The first sweet sorghum seed to reach the United States came from that country, in 1855, and in 1856 from South Africa. The sorghums are remarkable for their adaptability to different conditions of soil and climate, and an almost endless list of varieties exists, which may be divided into two main groups based upon the character of the sap. Those containing a considerable amount of sugar are classed as saccharine sorghums, those weak in sugar as non-saccharine. The name sorghum is applied in common use to the saccharine varieties only, while the non-saccharine varieties commonly bear the name of their variety, as Kaffir corn, durra, etc. The different varieties of the sweet sorghums are so nearly alike that little distinction is made in treating them as a class. The two leading varieties are the amber and the orange, the former being the favorite in the more northerly latitudes of the United States, and the latter in the south and the southwest. Sorghum thrives in every part of the United States except in the colder parts of New England and in the higher parts of the Rocky Mountains. At first it was grown exclusively for the manufacture of syrup and sugar, but as its value as a forage crop became known, the area devoted to its cultivation increased rapidly.

Saccharine Sorghums.— The Civil War caused a scarcity of sugar in the United States, and sorghum syrup came into widespread use as a substitute. In 1860, five years after the first seed was introduced from China, 6,749,123 gallons of sorghum syrup were made and consumed in the United States. In 1870 the production had swelled to 16,050,089 gallons, and in 1880 to 28,444,202 gallons. Since that time the production of sorghum has shown a steady decrease, being only 16,972,783 gallons in 1900. In the manufacture of syrup the stalks are stripped of their leaves after the seed has ripened, and the tops are cut off. The stalks are then cut off close to the ground and passed through heavy rollers to extract the juice, which is then boiled in shallow pans until a syrup of the desired consistency is obtained. The greater part of the sorghum now manufactured is a farm product, all of the operations of manufacture being performed on the farm. In 1878 the United States Department of Agriculture took up experiments to ascertain whether sugar could be manufactured profitably from sorghum. Two objects were aimed at in the experiments, (1) to discover a cheap process for extracting the juice and making the sugar and (2), to increase the sugar content of the plant. Considerable progress was made along both these lines, and the chemists in charge of the work at one time thought that sorghum would become a competitor of sugarcane as a source of sugar. Attempts were made by capitalists to manufacture sorghum sugar on a commercial scale; but none of these attempts have proved successful. The only satisfactory process of getting the sugar to crystallize properly involves the use of a large amount of alcohol, which, under present government regulations, is so expensive as to make the process impracticable.

Sorghum is valued highly by stockmen as a soiling crop, and makes good summer pasturage for all kinds of stock. Its high sugar content gives it an especial value in fattening swine, and it is also an excellent food for sheep. As ensilage it makes good feed, but on account of the difficulty in preventing the development of acidity in the silo, other crops are generally preferred for this purpose. Sorghum is of especial value as a pasturage plan , owing to the fact that it is at its best in midsummer, when other grasses are generally of the least service. The heavy yield of hay makes it one of the favorite forage crops. In pasturing care is necessary on first turning stock upon sorghum, owing to the danger of bloating.

The time for planting sorghum varies according to latitude from the 1st of April to the middle of June. In general the best results are obtained by sowing the seed broadcast or with a drill, as oats or wheat are sown. When intended

Digitized by Google

for a soiling crop it is sometimes better to sow in rows far enough apart to admit of plowing between the rows. The amount of forage yielded per acre varies according to soil, climate and methods of cultivation, and ranges up to as much as 15 tons of cured hay per acre. Two or three crops are sometimes harvested in a single year, and as much as ten tons is sometimes obtained from a single cutting. Experiments at the Nebraska Experiment Station showed sorghum to be the heaviest yielder of all the forage crops at that station. It is a deep feeding plant, and gives better results on poor land than does corn, but is more exhausting to the soil. In feeding sorghum the whole plant is usually used. The seed alone has a feeding value of about 90 per cent that of corn, and is valued highly for poultry, especially for laying hens. Bulletin 15 of the Department of Agriculture compares the composition of sorghum seed and corn as follows: Corn (shelled) water 10.9; ash 1.5; fibre 2.1; fat 5.4; protein 10.5; nitrogen-free extract 69.6; sorghum seed, water, 12.8; ash 2.1; fibre 2.6; fat 3.6; protein 9.1; nitrogen-free extract 70.0.

Non-saccharine Sorghums.— These exist in many varieties, all with the same general habits of growth, being slow to germinate and requiring a long period to mature seed as compared with corn. They differ in the length, thickness and strength of the stem, in the number and size of the leaves, and in the position of the seed-head. The principal varieties are Kaffir corn, Milo maize, durra, (doura, dhourra or dhoura), Jerusalem corn, and broom corn. All of these varieties except the last are grown principally as feed for stock. The peculiar adaptability of broom corn to the manufacture of brooms and brushes has led it to be devoted entirely to this purpose.

Kaffir corn is the best-known of those grown as feed for stock. It was introduced from South Africa about 1884, distributed by the Department of Agriculture, and has been found well fitted to the semi-arid regions of the West and Southwest, where corn has never been a reliable crop. It is now extensively cultivated in Oklahoma, western Kansas and other places where lack of moisture give this crop an advantage over corn. In appearance Kaffir corn resembles sorghum, but does not grow so tall. The leaves are large and long, the head is upright and compact, and the seeds vary in color according to variety. Three distinct varieties have been generally agreed upon — red, white, and black-hulled white. The last frequently goes by the name of African millet. Kaffir corn is used chiefly for a fodder crop, is planted in drills and cultivated like corn or sorghum. Where it is proposed to feed the whole fodder to stock, the crop is cut and shocked as soon as the grain is ripe. Where the heads are to be harvested by themselves various methods of harvesting are used. The yield is about the same as that of corn grown under the same conditions, except in dry, hot regions, where the Kaffir corn will out-yield Indian corn. The crop of fodder yields up to eight tons per acre or more, but the seed has a lower feeding value than corn. The grain has been used as an article of human food, making a meal similar to corn-meal. The acreage of Kaffir corn in 1900 was 266,513 acres, and the yield of grain 5,169,113 bushels.

Milo maize closely resembles Kaffir corn, but grows to a greater height. It is marked by a heavy foliage and an abundance of suckers. Owing to the fact that it requires a long period to mature it has been found best adapted to cultivation in the Southern States. Two varieties are grown in the United States, white and yellow.

Durra differs from Kaffir corn principally in the position of the head, which hangs downward from the end of the stalk, the culm being recurved just below the panicle. This variety includes Egyptian corn, rice corn, guinea corn, etc. The grain is a favorite poultry-food, and the plant has been extensively cultivated in some parts of the United States for this purpose. It is also valuable as a forage plant.

Jerusalem corn grows to a height of 4 to 8 feet, but produces less forage than other varieties. The grain yield is large as compared with that of other non-saccharine sorghums, but is hard to save, owing to the fact that the grains are without husks and shatter easily. The head hangs downward on a recurved stalk as in the case of durra.

Broom Corn.— Broom corn is the oldest variety of the non-saccharine sorghums cultivated in the United States. Brooms were made for sale in the United States as early as 1798, and the plant was cultivated for home use for some time previous to this. The usual development of the stems of the seed-cluster adapt it perfectly to the purpose of brooms and brushes, and it is not cultivated for any other purpose, although sometimes fed to stock after the brush has been removed. There are several varieties, whose distinctions depend on the size and coarseness of the plant and the quality of the head. The plants are usually grown in drill rows. The heaviest producers of broom corn are the States of Illinois and Kansas, though conisderable quantities are produced in many other States. The area devoted to broom corn in 1899 was 178,584 acres, with a value of $3,588,414. The American broom corn is superior to that grown in Europe for purposes of broom manufacture.

Diseases of Sorghum.— Sorghum blight (*Bacillus sorghi*) is a bacterial disease in which the leaves or leaf sheaths are attacked by small red spots and patches of various shades and sizes. The roots are also subject to attack from the same source, and the vitality of the plant is so affected that it is either stunted or killed. The disease is worse on some varieties than others, but it attacks both the saccharine and the non-saccharine varieties. Of the smuts (*Ustilago sorghi* and *U. reiliana*), the former attacks the grain, causing it to swell up and burst, and the latter attacks the entire head, converting it into a large black mass which is covered at first by a whitish membrane. No preventive treatment has been applied successfully.

Sorghum Poisoning.— Cases have been frequent, especially in the semi-arid districts, of cattle dying from eating even a little green sorghum, usually a second-growth. Investigations carried on by the Nebraska Experiment Station go to show that under some conditions sufficient prussic acid forms in the leaves of the plant to cause the death of an animal. The danger is confined to the feeding of the green plant.

Sorites, sō-rī'tēz, in logic, a chain of elliptic syllogisms — of syllogisms in which the con-

Digitized by Google

clusion of all except the last is omitted. The syllogisms are stated in a series of propositions so linked together that the predicate of each is the subject of the one next following, till a conclusion is formed by bringing together the subject of the first proposition and the predicate of the last. The chain can be carried to any length provided it is perfectly consecutive, so that each term except the first and the last occurs twice, once as subject and once as predicate. Example of sorites:

Every A is B.
Every B is C.
Every C is D.
Every D is E.
Therefore every A is E.

Or, expressed in words:

Titus is selfish.
A selfish man is neglectful of the good of others,
Whoever is neglectful, etc., is destitute of friends,
Whoever is destitute of friends is wretched,
Therefore Titus is wretched.

The three syllogisms implied in this sorites are:

First syllogism.	Second syllogism.	Third syllogism.
Every B is C,	Every C is D,	Every D is E,
Every A is B,	Every A is C,	Every A is D,
∴Every A is C.	∴Every A is D.	∴Every A is E.

Sorocaba, sō-rō-kä'bä, Brazil, a town in the state of São Paulo, situated on the railroad, 55 miles west of São Paulo. It lies in the midst of a rich agricultural and grazing district, and important fairs for the sale of horses and cattle are held in the town annually. Pop. of commune about 17,000.

Soro'sis, the name of the first professional woman's club established in the United States. Sorosis was founded in 1868 by Mrs. «Jennie June» Croly (q.v.) and some of her literary associates in New York. Mrs. Croly was for many years the president of the society. The membership in 1903 was upward of 200. Meetings are held weekly.

Sorrel, Sorrel-tree, Sorrel Vine, etc., are the like names of several unrelated plants having acidulous or «sour» foliage. The field or sheep sorrel is the *Rumex acetosella,* a common pasture weed, naturalized from Europe, with halberd-shaped leaves, impregnated with oxalic acid, slender panicled racemes of delicate diœcious flowers, with six-parted, green or reddish calyces. It spreads widely by creeping rootstalks and in late summer colors large patches of dry fields and hillsides by its crowded rusty-hued flower stalks and foliage. This species, *R. acetosa,* and particularly *R. scutatus,* which is cultivated for the purpose in Europe, are used for salads, soups and as vegetables. They are cooling, diuretic and anti-scorbutic plants. The wood sorrel may be any one of the American species of *Oxalis,* low plants with succulent tripartite leaves and obcordate leaflets, and pretty solitary and umbellate five-parted flowers, white, pink or yellow, and with sharply acid sap. Indian sorrel is the roselle, an East Indian mallow (*Hibiscus sabdariffa*) cultivated in the tropics for its acidulous calyces which are made into refreshing drinks, jellies and tarts. Switch sorrel is the *Dodonæa viscosa,* a widely distributed tropical shrub, with acid and bitter foliage. Climbing sorrel is the shrubby *Begonia scandens,* which climbs by rootlets. The sorrel vine is a low, tendril-bearing climber (*Cissus,* or *Vitis acida*) of tropical America. *Oxydendum arboreum* is the sour-wood or sorrel-tree of the southern United States. It is a smooth-barked tree of the heather family, with alternate oval leaves, deciduous and sour in taste. The 5-merous cylindrical flowers are in one-sided, slender racemes and in terminal panicles. They have a honey-like odor, and are food for bees. The capsules are pyramidal, five-valved, and a soft, pale green in color. The leaves are occasionally used to furnish a black dye, and the wood serves for tool-handles, bearings of machinery and for turning.

Sorrel Cool Drink. See Hibiscus.

Sorrento, sōr-rĕn'tō (ancient Surrentum), Italy, in the province of Naples, on the southeast side of the Bay of Naples, seven miles southwest of Castellamare. It is built on the steep mountainous slope of a promontory extending into the bay, in one of the most beautiful and fertile regions of Italy, amid orange, lemon, olive and mulberry groves. A roadway following the coast forms a favorite promenade from the town to Castellamare. Sorrento contains a few interesting ruins of its ancient splendor belonging to the Augustan period. It is the seat of an archbishop, and has a cathedral. Other buildings are a seminary and a school of navigation; also a monument to Tasso, who was born here. The wine of Sorrento is famous. The inlaying of wood, and silk-culture; the manufacture of silk, cultivation of fruit, stock-raising and fisheries are the chief occupations. It depends, however, mainly upon its attractions as a summer resort, which it owes to a fine climate and picturesque scenery.

Sorrowful Mother, Sisters of the. See Orders, Religious.

Sorrows of Werther, The (Das Leiden des jungen Werther), a novel by Goethe, published in 1774, representing a phase of the romantic movement in the late 18th and early 19th century. It was the forerunner of a large body of sentimental literature. The counterpart of this movement was represented in England by what was called Byronism.

Sorsogon, sŏr-sō-gōn', Philippines, (1) Pueblo, capital of the province of Sorsogon, Luzon, on Bay of Sorsogon. The bay is 19 miles in length from the town to its entrance and affords one of the best harbors in the Philippine Archipelago. Sorsogon is a port of call for steamers from Manila, and has a considerable export trade, particularly in hemp and copra. In 1840 it suffered from an earthquake which lasted almost continuously for 35 days: the churches were destroyed, 17 persons were killed and many injured, and the ground for some distance sank five feet below its former level. Pop. 10,720. (2) Province of the island of Luzon, situated in the extreme southeastern end of the peninsula of Luzon, bounded on the north by the province and the bay of Albay, and on the south by San Bernardino Strait, length from northwest to southeast 47 miles; greatest width 40 miles; area, 663 square miles, with dependent islands, 675 square miles. The coast line is very irregular, on the northwest coast is the deep indentation of the Bay of Sorsogon; and on the

Digitized by Google

northeast coast Sógod Bay, an arm of Albay Gulf; from the extreme northeast shore of the Bay of Sorsogon to the nearest waters of Sógod Bay the distance is but three miles. The mountain system of the province includes a range in the north, forming the boundary line with Albay, and another range extending from northeast to southwest, forming the central watershed; but nearer the east coast than the west. In this range is the active volcano of Bulusan, visible for 60 miles at sea. The largest river of the province rises on the western slopes of Bulusan; there are many small tributary streams. There are comparatively few highways, one road connects Sorsogon with Bacón on the opposite coast, and there are several trails, there is much coastwise trade in native canoes. The staple products of Sorsogon are hemp and copra (a product of the cocoanut, the form for shipment to be made into oil), and large quantities of both are exported. Native textiles, cordage, etc., are manufactured from the hemp; and the cultivation and manufacture of hemp, and the cultivation of the cocoanut are the principal industries. Sorsogon was formerly a district of the province of Albay, and in 1901 was created a province and placed under civil government in accordance with the provision of the law of the Philippine Commission. Pop. 98,650.

Sortes, sôr'tēz (Virgilianæ, Homericæ, Biblicæ, etc.), a mode of divination by means of a passage or verse in some poet's works or in the Bible. One way of practising this kind of divination was to open the book at random and to take whatever passage or verse is touched by the finger as an indication of the fortune of the inquirer. Another way was to select a number of verses from a poet or from one of the books of the Bible, write them on slips of paper, mix these in an urn, draw one slip at random, and from its contents infer good or evil. The Sibylline oracles (see SIBYL) were also employed in this way. Sortes Virgilianæ, are so called, as being practised with verses from the poet Virgil, Homericæ from Homer, and so on. In Persia *sortes* are determined by resort to the poems of Hafiz. It is said that the Roman Emperor Severus, who reigned from 193 to 211 A.D., found an intimation of his high destiny in that verse of the Æneid,

> Tu regere imperio populos, Romane, memento;

and that the Emperor Gordianus (self-slain after a reign of 36 days) read his doom in this passage of the same poem:

> Ostendunt terris hunc tantum fata, nec ultra
> Esse sinunt.

Charles I. and Lord Falkland tried the Sortes Virgilianæ in the Bodleian library at Oxford and found passages equally ominous to each. The use of the Scripture books for divination still lingers among people of simple faith; and the obstinate survival of this superstition is due to a strong conviction of the power and watchful care of an overruling Providence and a belief in the Bible as an inspired manual of divine guidance: if resort is less often had in these times to the Sortes Biblicæ, that may be due to the decaying respect for the mere letter of Scripture.

Sothern, sŭth'ẽrn, **Edward H.,** American actor, son of E. A. Sothern (q.v.): b. London. He first appeared with his father in a small part at Abbey's Park Theatre, New York, and became leading man at the Lyceum Theatre in 1887. Shortly thereafter he became a star appearing at the head of his own company in such plays as 'Lord Chumley,' 'Maister of Woodbarrow,' 'Prisoner of Zenda,' 'The King's Musketeers,' 'Lovelace,' 'If I were King,' 'The Proud Prince,' and 'Hamlet' (1900), occasional revivals since. His interpretation of 'Hamlet' is modeled somewhat on that of Edwin Booth, is romantic and effective, but at times prone to exaggeration. In 1896 he married the actress, Virginia Harned.

Sothern, Edwin Askew, English actor: b. Liverpool, England, 1 April 1826; d. London 21 Jan. 1881. In 1849 he joined a company of strolling players, and soon afterward passed into the stock company of the Theatre Royal, Birmingham. From 1852 he appeared in the United States without attracting much attention until in 1858 'Our American Cousin' was brought out in New York, with Sothern cast for the small part (47 lines) of Lord Dundreary. Sothern built up the character, making it the leading feature of the play, and one with which his name has ever since been connected. He acted other parts, with more or less success, and was always popular in America, which he frequently visited.

Sou, soo, an old Roman, Gallic and French coin, of gold, silver and copper. In France the current 5 centime piece, 20 of which make a franc, are commonly called sous.

Souari, or **Suwarro, Nuts,** the seeds of the genus *Caryocar* (*Ternstræmiaceæ*), lofty trees yielding timber prized for its durability, and common in British Guiana. *C. nuciferum* is the chief source of supply of these nuts, having digitate leaves, 5- to 6-parted, large, magenta-colored flowers, and a fruit which is a spherical, hard, woody shell, as large as a child's head, reddish-brown in color, and covered with roundish protuberances. It contains four seeds, the souari nuts, which are kidney-shaped, about the size of an egg, with a ruddy brown shell, that is very hard but has a satiny lining, and encloses a soft, pure white kernel in a brown skin. This rich meat, with its sweet, almond-like flavor, is considered to be the finest of all nuts. A bland oil is expressed from the kernels and they are called butter-nuts in the English market, or cream-nuts in the American. Since there is great difficulty in gathering them, on account of the bulk of the trees, the supply is restricted.

Soubise, Benjamin de Rohan, bŏn-zhä-măṅ dė rō-äṅ soo-bēz, SEIGNEUR DE, French Huguenot soldier: b. Rochelle, France, 1583. He was a son of René II., Vicomte Rohan, and a younger brother of the soldier-writer, Henri de Rohan. He served his apprenticeship as a soldier under Maurice of Orange and when the religious wars broke out in 1621 was entrusted with the chief command of the west, while his brother commanded the land forces in the south. In 1625 Soubise made a daring attack on the royalist fleet in the river Balvet, and occupied the island of Oleron. He also commanded in the defense of Rochelle, but was unable to save the town, and when it fell he fled to England.

Soudan, soo-dän'. See SUDAN.

Digitized by Google

Soufflé, soo-flā', a dish consisting chiefly of the whites of eggs, to which other ingredients (chocolate, cheese, vanilla, orange-flower water, rose water, various essences, etc.) are added, to give consistency, flavor, and variety. The materials have to be agitated with a whisk till the whole is in a creamy froth, which is then baked in a soufflé pan.

Souffrière, La, lä soo-frē-ār. See SAINT VINCENT.

Soul, the rational and spiritual part in man which distinguishes him from the brutes, enables him to think and reason and renders him a subject of moral government; but sometimes «soul» designates the principle of life, the seat of the sensitive affections and phantasy: this so-called «animal soul» is regarded as common to man and all animated creatures. For Plato, the soul is a self-moving activity, and in it he distinguishes the appetitive soul, seeking the gratification of desire; the contentious (or irascible) soul, manifested in combative activity; and the rational soul, which alone is immortal. Is the soul of man a unity or a complex? Has man two souls, an animal or instinctive one like the soul of brutes, and a reasoning one proper to man alone? If man has two souls it appears easy to account for the many analogies between men and brutes: but if in us it is the animal soul that is the agency of sensation and feeling, we certainly have no consciousness of this double activity, so that if we are to attribute sensation to the lower soul we must be unconscious of it; but if to the higher, we must allow both to the brutes as well as to ourselves. Modern materialists regard soul as a result of organism, as a consciousness resulting directly from matter in a given stage of organization: for them the seat and the agency of thought is the organism, matter. But we know that none of the simple forms of matter exhibits any phenomena of consciousness: no trace of perception, memory, or volition in matter has ever been discovered by modern materialists, though so much is now ascertained regarding the more important constituents of vital organisms. The materialists see in mental action nothing but the operations of organism: Leibnitz, contrariwise, sees in the whole material universe nothing but «individual centres of force or monads.» The monads are «the very atoms of nature, the elements of things»: they are metaphysical points or rather spiritual beings. But the soul as a spiritual substance is as unimaginable as the soul as a function of organism: what then is it possible to know about the soul? Much, both negatively and positively. We find organized beings of all kinds which give manifest signs of intelligence; those organisms we can trace to simpler forms of matter in which are no such signs of intelligence: for all that modern research has discovered of the behavior of the elementary matters composing an organism nothing has been found to suggest the probability or possibility of intelligence in them. It is a fair inference, then, not merely from our inability to conceive of matter as thinking, but from actual investigation, that although we find organized material forms in which thought is present, intelligence is not a known property of matter: and whoever asserts that in an intelligent being there is nothing but organized matter asserts what he cannot prove and has no ground for thinking. But on the other hand when it is asserted that the soul is immaterial, that is, something different from anything which we have been able by the use of our senses and the exercise of our reason to discover in matter, that is a proposition to which we are bound to assent. And we are able to carry our positive knowledge regarding the soul further in another direction. For we know that the soul, as an individual intelligence, has had an origin: we know that it was not self-originated: we know that it could not have originated in any thing or any number of things without intelligence: intelligence cannot spring from non-intelligence; we know that our soul is related to a bodily organism which it is capable in many ways of controlling and through which it is related to the whole physical universe; and that in that universe it discovers a uniformity of laws through which it exercises an indefinite control over physical objects: we know therefore that this universe is under the control of the Intelligence in whom our soul originated. Consult Driscoll, ‹Christian Philosophy, a Treatise on the Soul› (1901).

Soulé, soo-lā', **Pierre**, American statesman: b. Castillon, France, September 1802; d. New Orleans, La., 26 March 1870. He received most of his education at Toulouse, having been interrupted in his studies at Bordeaux by an accusation of complicity in a plot against Louis XVIII. in consequence of which he was obliged to flee. Soon after his pardon in 1824 he was again exiled on account of the publication of articles in his paper ‹The Yellow Dwarf,› derogatory to the course of the ministers of Charles X., and took up his residence at this time in America. A few years later he was elected to the United States Senate from Louisiana, and was still later entrusted with the negotiations of the United States government with Spain for the purchase of Cuba. During the Civil War he was a member of Beauregard's staff. At the conclusion of hostilities he took up his law practice in New Orleans.

Soult, soolt, **Nicolas-Jean de Dieu**, marshal of France: b. Saint-Amans-la-Bastide, department of Farn, 29 March 1769; d. Soultberg 26 Nov. 1851. He entered the army as a common soldier, but was soon distinguished for gallant conduct and raised from the ranks. In the campaign of the upper Rhine in 1792–4 he was brevetted general of brigade, and in 1799 was made general of division and served with distinction with Massena in Switzerland and Italy. From this time forward he became an ardent champion of Napoleon by whom he was appointed marshal at the beginning of the Empire. His military genius was further proven at Austerlitz, where he decided the battle by cutting in two the main body of the Russian troops, and in numerous other battles, the most conspicuous being that of Friedland in the Prussian campaign in 1807. Upon the fall of Napoleon he was appointed minister of war by Louis XVIII., but was compelled to resign by the royalist party. He acted as major-general of the army at Waterloo, but was obliged to flee from France at the second Bourbon restoration. Returning in 1819, he was again appointed minister of war, and in 1839 minister of foreign affairs. In 1846 he was created grand-marshal of France, and retired to private life. Consult: Soult, ‹Memoires›; Thiers, ‹History of the Revolution and the Em-

Digitized by Google

pire'; and Salle, 'The Political Life of Marshal Soult' (1834).

Soumy, soo'mē, or **Sumy,** Russia, a fortified town in the government of Kharkov, 125 miles northwest of the city of that name, on the bank of the Psiol River. It has nine churches, schools of elementary and grammar grades, banks, and four annual fairs. There is a large sugar manufactory, several distilleries, and considerable trade in liquor and agricultural products. The imports are provisions and manufactured goods.

Sound. See ACOUSTICS; VIBRATION.

Sound, The, or **Oeresund,** ė'rä-soond, Denmark, the easternmost of the three channels which connect the Kattegat with the Baltic Sea. It separates the Danish island of Zealand from the southern extremity of Sweden. Its length is about 30 miles, and its breadth varies from less than 3 miles at the northern end, between Elsinore and Helsingborg, to 16 miles between Copenhagen and Malmö. Since the opening of the Kaiser Wilhelm Canal the Sound has lost some of its importance, but is still navigated by numerous vessels. Sound duties were formerly levied by Denmark on all ships passing through it, but these were abolished in 1857.

Soundings, the operation of trying the depth of deep water and the quality of the bottom, especially by means of a plummet sunk from a ship. In navigation two plummets are used, one called the hand lead, weighing about eight or nine pounds, and the other, the deep-sea lead, weighing from 25 to 30 pounds. (See LEAD.) The former is used in shallow waters, and the latter at a distance from shore. The nature of the bottom is commonly ascertained by using a piece of tallow stuck upon the base of the deep-sea lead, and thus bringing up sand, shells, ooze, etc., which adhere to it. The scientific investigation of the ocean and its bottom has rendered more perfect sounding apparatus necessary, and has led to the invention of various contrivances for this purpose. See OCEAN.

Soup, a decoction of flesh in water, properly seasoned with salt, spices, etc., and flavored with vegetables and various other ingredients. There are very many kinds of soup, the introduction of a different ingredient furnishing the occasion for a distinctive name, but they may all be divided into two classes — clear soup and thick soup.

Sourkrout. See SAUERKRAUT.

Sour'lake, or **Sour Lake,** Texas, city in Hardin County; about 20 miles northwest of Beaumont, in an agricultural region and a section rich in oil. For several years Sourlake was a health resort, taking its name from springs which possessed medicinal properties. In 1902–3 prospectors began to sink oil test-wells in the pine forests around the springs, with the result that oil in large quantities was found. So many derricks were erected in rows so closely together, that one portion of the oil-field was called the "Shoestring district." Sourlake was at once connected with Beaumont and Port Arthur by pipe lines until such time as its own storage buildings were ready for use. Considerable of the oil is sent direct to refineries. The first part of the year 1902, Sourlake was a stretch of prairie at the edge of a pine forest; 1903 saw it a village of about 200 inhabitants with some visitors to the springs. The census of 1910 gave the population as 4,900.

Soursop, the edible fruit of *Anona muricata,* a small, much-branched, ornamental tree, cultivated in the East and West Indies. This fruit is large, pear-shaped, covered with soft prickles, greenish in hue outside, but containing a white succulent pulp, with an odor suggesting black currants, and a peculiar, but pleasant, sub-acid taste.

Sousa, soo'za, **John Philip,** American musician: b. Washington, D. C., 6 Nov. 1854. His musical talents were so early developed that he was a band-leader at 17. His wider fame began with his leadership of the U. S. Marine Corps band in 1880–92, and became national with the organization of the band which was known by his name in 1892, and which later made concert tours of the principal European cities. He is the author of numerous musical compositions, but is best known as a composer of popular marches.

Sousa, sō'zä, or **Souza, Martim Affonso de,** Portuguese colonist and governor in South America: b. Bragança about 1500; d. Lisbon 21 July 1564. In 1530 Sousa, an army officer, was despatched in command of a fleet of five sail with a force of 500 to colonize Brazil. The commonly-received statement is that he discovered the bay which he supposed to be the mouth of a river and named Rio de Janeiro 1 Jan. 1531. But there is some doubt as to whether he was in the bay on that date, and there are records of earlier visits by others. On 22 Jan. 1532 he founded at São Vicente the first Portuguese colony in Brazil. There he introduced the sugarcane, which he had brought from Madeira, and built the first sugar-mill in the country. In 1533 he was recalled, and in 1534 made captain of São Vicente, whose affairs he continued to administer, though he did not again visit it. He was admiral of the seas of India in 1534–40, and governor of the Portuguese East Indies in 1542–5.

Soutane', a close-fitting long coat reaching to the ankles, which is the distinctive dress of clerics in the Roman Church. For priests and the inferior orders of the clergy it is black; for bishops and other prelates, purple; for cardinals, red; for the Pope, white. The soutane (also called cassock) is the ordinary outer garment of clerics; and a decree of the Council of Trent requires all clerics, if in sacred orders and holding a benefice, to wear at all times this clerical dress; but this rule is not enforced in Protestant countries.

South, SIR James, English astronomer: b. London October 1785; d. there 19 Oct. 1867. He was educated as a surgeon and gave up a large practice in London to pursue the study of astronomy. In 1816 he fitted up a private observatory at his home, and devoted all of his time to astronomical investigation. He was the discoverer with Sir John Frederick William Herschel of 380 double stars, which were catalogued by them in 1833. In 1835 he removed his telescope to France, where he made other important observations. He was knighted for his services in behalf of science in 1830.

South, Robert, English Anglican divine: b. Hackney 4 Sept. 1634; d. Westminster 8 July

Digitized by Google

1716. He was educated at Oxford and after traveling on the continent took orders in the Church of England in 1658. He was university orator 1660–77, became prebendary of Westminster in 1663, in 1667 was made chaplain to the Duke of York, and in 1670 was appointed canon of Christ Church. In 1676 he accompanied Lawrence Hyde, afterward Earl of Rochester, who went as ambassador to Poland, and on his return was appointed rector of Islip, Oxfordshire. Stories are told of his preaching before Charles II. and causing that monarch to laugh over his sarcastic allusions to Cromwell and the Puritans. Whether the anecdote be genuine or not, South never received the bishopric that Charles in his good humor proposed for him; and under James II. there was less likelihood of preferment since South's hatred of Roman Catholics was as strong as his contempt for Puritans. He hesitated for some time at the event of the Revolution over the matter of his allegiance but finally adopted the parliamentary fiction that the flight of James was in effect an abdication. In 1693 he entered upon his great controversy with Sherlock, dean of Saint Paul's, occasioned by the latter's 'Vindication of the Doctrine of the Trinity,' which South answered by his anonymous 'Animadversions,' full of learning, and incisive logic as well as fierce sarcasm and petty personalities. To Sherlock's 'Defence' South published a rejoinder, 'Tri-theism charged upon Dr. Sherlock's new notion of the Trinity'; and the controversy became the talk and ridicule of the town until the king himself intervened. In 1713 he refused the see of Rochester and the deanery of Westminster. His sermons are masterpieces of clear thought, direct and vigorous in English, sometimes rising to eloquence, often spiced with a wit and sarcasm unusual in pulpit utterances, and straining at times the bounds of propriety. His sermons were published by himself in 1679–1715; an additional volume in 1717 contained his 'Memoirs' and the account of the Polish travels. Modern editions were published in 1823; 1842; 1843; 1845, with the Memoir; and 1850.

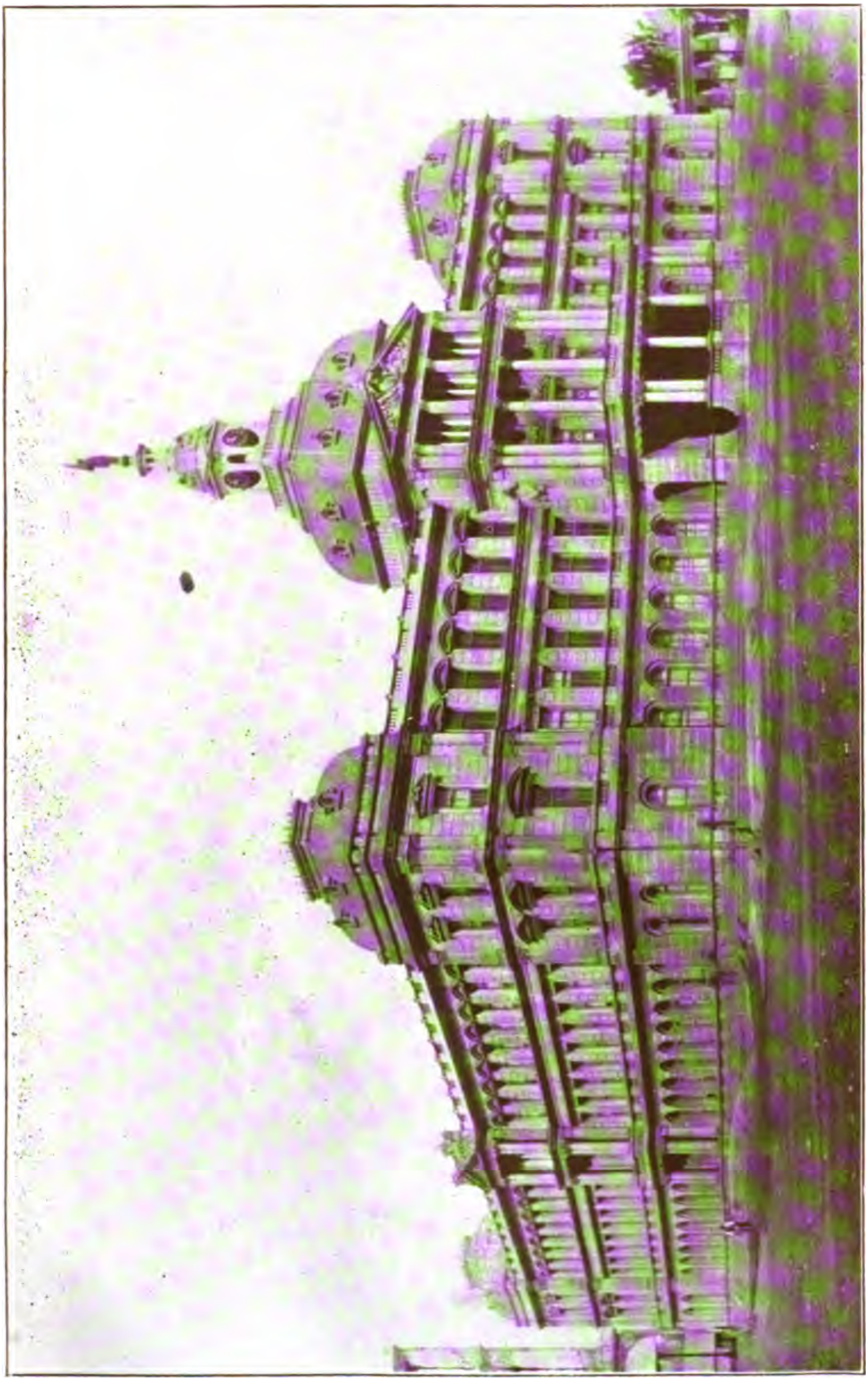
South Africa Company, British. See British South Africa Company.

South African Republic. See Transvaal Colony.

South African War, a conflict (1899–1902) between Great Britain on one side and the South African Republic (Transvaal) and the Orange Free State on the other. A considerable body of the Dutch population of South Africa have never been reconciled to the rule of the British, and reasonable grounds for discontent have not been wanting. (See Boers.) The settlement agreed to by Gladstone's government in 1881 after Majuba Hill (q.v.) — followed in a modified form by that of 1884 — was generally looked upon by the Boers of the Transvaal as a triumph for them. "Majuba day" was annually celebrated as commemorating a great event in their history, and this tended to keep alive a spirit of hostility to Great Britain, and perhaps to foster thoughts of a greater triumph that might be attained in the future. The wars with the natives, continued even after 1884, had made the Boers on the whole a military people, and about 1893 President Kruger (q.v.) began to increase the Transvaal armaments, seeing that nothing but force could ultimately keep the Uitlanders — the non-Boer settlers in the Transvaal, especially in Johannesburg (q.v.) — from gaining political rights, and that force would also be necessary to enable him to get rid entirely of British supremacy, and to secure, what he had long desired, free access to the coast. The Jameson Raid (see Jameson, Leander Starr), an ill-advised attempt made at the close of 1895 by a handful of British subjects, who invaded the Transvaal with a view to gaining some advantage for the Uitlanders — furnished ground for increasing the warlike equipments of the country, and the gold mines of the Rand (see Witwatersrand) supplied the funds which were spent on rifles, artillery, ammunition, etc., all of the newest and best. These funds had to be provided in part by the Uitlanders, who, though they bore the bulk of the taxation, and owned a great share of the property in the Transvaal, were excluded from any share in the government, and were treated in a harsh and domineering spirit. Early in 1899 a numerously signed petition from British residents in the Transvaal was forwarded by Sir Alfred Milner (q.v.), the high commissioner, to the home government, setting forth the grievances of the petitioners, and declaring their position to have become "intolerable." It was then arranged, on the invitation of President Steyn (q.v.) of the Orange Free State, that matters should be discussed between the high commissioner and President Kruger at the Free State capital, Bloemfontein. The parties held meetings from 31 May to 5 June, but no agreement was arrived at. President Kruger now submitted to the Transvaal Volksraad a franchise scheme of his own, professedly meeting all legitimate or reasonable claims of the Uitlanders. To this many of his friends gave their approval, though Sir A. Milner thought it came far short of what was required. Then followed more negotiations, which sometimes seemed to give hope of a satisfactory result; but, apart from the franchise question, the claim of the South African Republic to the status of a perfectly independent state still barred the way to a settlement. Meantime the war spirit was rising in the Transvaal. On 8 September the British cabinet decided to raise the garrison in South Africa to a strength sufficient to protect the colonies. On 22 September the South African Republic presented an ultimatum, delivered to the British agent in the Transvaal on 9 October, for answer within 48 hours, demanded that all matters in dispute should be settled by arbitration or in some other way to be agreed on; that all troops on the borders of the republic should be instantly withdrawn; that reinforcements which had arrived in South Africa since 1 June should be removed from South Africa within a reasonable time; and that the troops then on their way to South Africa should not be landed. War at once followed, the Orange Free State, by a previous arrangement, joining the neighboring republic.

The war was actually begun by the Boers invading Natal and Cape Colony (qq.v.), Ladysmith in the former and Kimberley and Mafeking in the latter being the places in which the greatest interest was almost immediately centred. At the beginning of the struggle the British regular troops in South Africa did not greatly exceed 20,000 in number, about half of them

Digitized by Google



THE HOUSE OF PARLIAMENT, PRETORIA.

Digitized by Google

Digitized by Google

being in Natal under the command of Sir George White, who had his headquarters at Ladysmith. On 20 October the Boers who had invaded northern Natal endeavored to cut off the British camp near Dundee, where Gen. Symons was stationed with about 5,000 men. They were repulsed at Talana Hill, but the British general was mortally wounded; and the following day they were more severely defeated at Elandslaagte by Gen. French's force from Ladysmith. It was necessary, however, to withdraw the northern garrison to Ladysmith, and this was done — after the Boers had been beaten off by Gen. White at Rietfontein. The Boers were now in such force that (with Gen. Joubert as commander-in-chief) Ladysmith was soon completely invested, the railway from the south being seized, as well as the bridge over the Tugela at Colenso. Several naval guns had been got into Ladysmith before this, which enabled its defenders to reply to the powerful artillery that the Boers had planted on the neighboring heights. Swarming down into Natal the invaders overran the country as far as the Mooi River and beyond, and it appeared that they might even attack Maritzburg; but the first army corps of 54,000 men reached South Africa in November, and Gen. Sir Redvers Buller, who had arrived to take supreme command, took under his charge a large portion of this force, and so was able to drive the Boers back and prepare for the relief of Ladysmith. Other divisions of the reinforcements were despatched inland from Cape Town, Port Elizabeth, and East London to aid in checking the Boer advance into Cape Colony, and to open the way to Kimberley. The force which undertook the latter task was under the command of Lord Methuen, while Gen. Gatacre was to operate against the Boers in the Stormberg district of the Cape Colony, French being in command of a British force between the two. Advancing northward, Methuen assumed the offensive, drove the Boers from a strong position at Belmont, defeated them two days after at Enslin, and on 28 November dislodged them from a strong position at the Modder River, which was crossed without opposition. Then followed a series of reverses to the British troops, which cast a gloom over the whole empire.

On 10 December Gatacre attempted a night attack on a body of Boers strongly posted near Stormberg, but after a toilsome night march his men unexpectedly came upon the enemy's position, which they were unable to capture, and were driven back with heavy loss. On the same day Gen. Methuen had shelled the Boers previously to attacking their position at Magersfontein, where, as at many places afterward, the Boer general De la Rey (q.v.) distinguished himself. Early next morning, while marching to the attack in quarter column, and on the point of deploying, the Highland brigade exposed itself to a close fire from the Boer trenches and lost very heavily, the commanding officer, Gen. Wauchope, being killed. The third and most serious reverse took place in Natal. On 15 December Gen. Buller attempted, by what has been generally regarded as an ill-judged plan, to force his way across the Tugela at Colenso, with the view of relieving Ladysmith. Notwithstanding a display of admirable courage on the side of the British, and certain partial successes, the plan as a whole entirely failed, the failure being aggravated by casualties in killed, wounded, and missing amounting to over 1,100, while 10 superior guns were abandoned to the Boers.

On receiving the news of Gen. Buller's repulse, the Cabinet decided to send out immediately the 7th army division already being mobilized, to call up the remainder of the army reserve, to incorporate a new yeomanry force, to allow 12 battalions of militia to volunteer for service abroad, to employ volunteers on active service, and to accept offers of help made by the great colonies. Lord Roberts was instructed to proceed to South Africa as commander-in-chief, with Lord Kitchener as chief of his staff: and Col. Hector Macdonald was appointed to succeed Gen. Wauchope in command of the Highland brigade.

When the year 1900 opened, the troops hemmed in at Ladysmith, Kimberley, and Mafeking were holding their own, but at the first place enteric fever had begun to make serious ravages, and to cause much anxiety. In the Cape Colony Methuen was confronted by Gen. Cronje in a strongly intrenched position; and Gatacre, after falling back from Stormberg, was holding Sterkstroom. French in the Colesberg district was more actively employed, and succeeded in defeating the Boers in several important actions. Lord Roberts and his staff arrived at Cape Town on 10 January, but before anything could be done by the new commander-in-chief, Buller made another attempt against the Boer position at Colenso (11 January). With this unsuccessful movement is associated the name of Spion Kop, an eminence in the scene of action the seizure and temporary occupation of which cost many British lives to no purpose. Yet a third attempt was made to break through to Ladysmith (5 February), Vaal Krantz being a position which figured most prominently on this occasion; but again the result was only disappointment, to the besieged force more especially. Meanwhile Roberts had been making plans for more effectively dealing with the enemy, and had got together a strong cavalry force under French between the Orange River and the Modder. While the attention of the Boers under Cronje was drawn off by a movement carried out by Macdonald and the Highland Brigade, French advanced rapidly on Kimberley and, in spite of all opposition, reached the place, dispersed the investing troops, and entered the town (16 February). Cronje at Magersfontein had now allowed himself to get into a difficult position, not fully realizing the strength and intentions of the British, and though he tried to escape eastward toward Bloemfontein, it was too late. He was brought to a halt at Paardeberg, took refuge in the bed of the Modder, where he managed to hold out for a week, but being completely hemmed in, and an attempt at his rescue by Gen. De Wet being defeated, he surrendered to Roberts with over 4,000 men. This was on 27 February, the anniversary of Majuba Hill. Cronje and the rest of the prisoners were sent to Saint Helena. Meanwhile fresh efforts were being made by Buller for the relief of Ladysmith, and this time with success. After a series of difficult operations, the Boer left was finally turned, and

Digitized by Google

on 28 February Lord Dundonald rode into Ladysmith, being followed by Buller two days later. The garrison was found to be in sore straits for want of food, and had suffered severely from disease as well as from the attacks by which they had been harassed. One of the fiercest of these had been made on 6 January, when the Boers had endeavored to take the town by storm, but were repulsed with heavy loss. On this occasion a position known as Wagon Hill had been three times captured and recaptured in the course of the day, Col. Ian Hamilton here greatly distinguishing himself. It has been said that "the successful defense of Ladysmith was from a military point of view the most valuable achievement of the war, inasmuch as the loss of a garrison of 12,000 men would have been a graver disaster than any conceivable defeat in the open field; and, moreover, the fall of Ladysmith was to be the signal for the general rising of the Dutch in the Cape Colony and Natal." Following on the successes in the west of the Orange Free State came successful operations by the generals in the northern parts of Cape Colony — Gatacre, Clements, and Brabant. Bloemfontein now became Roberts' objective, and after Joubert had vainly attempted to bar his way at Poplar Grove, and again at Driefontein, the British commander entered the capital of the Orange Free State practically without opposition (13 March). Kruger and Steyn fled to the north. The keys of the town were surrendered to Lord Roberts, and the railways being soon repaired, through communication was opened between Bloemfontein and Cape Town. The Orange Free State was proclaimed British territory.

There was a long halt at Bloemfontein, and during this period enteric fever proved a terrible scourge to the British, and the Boers were encouraged to fresh activity. Several mishaps now befell different bodies of British troops, and De Wet proved himself a leader of exceptional ability on the Boer side, while Louis Botha also gained distinction for himself, having succeeded to the chief command on the death of Joubert (27 March). The advance northward from Bloemfontein began on 3 May. The British forces under Gens. Ian Hamilton, French, and Pole-Carew, with Lord Roberts at their head, often showed a front of 40 miles, and though the enemy repeatedly seemed to threaten a determined stand, no effective resistance was encountered, either on the Vaal or elsewhere. One after another the Boer positions were turned; Botha's troops fled in confusion from Johannesburg, where the British flag was hoisted on 31 May, and Pretoria, the Transvaal capital, was occupied on 5 June, no attempt being made by the Boers to hold the forts. Gen. Botha and a considerable body of men retired eastward along the railway in the direction of Komati Poort, near the Portuguese frontier, in which direction President Kruger, Mr. Reitz, and other members of the Transvaal government had preceded him. The Boers were followed and beaten at Pienaarspoort, about 15 miles from Pretoria. Meanwhile Buller had been advancing northward through Natal, and had entered the Transvaal from that side, driving the Boers before him. On 15 May Dundee and Glencoe were retaken, on the 17th Newcastle, and by the end of the month he was encamped within striking distance of Majuba and Laing's Nek, which were strongly held by the enemy. But by a skilful turning movement Gen. Hildyard secured command of the Boer positions, which were at once evacuated. Buller's force had marched 50 miles in six days, and had defeated the Boers in four engagements. His troops were thus put in a position to co-operate with the main army under Lord Roberts, and early in July the railway all the way to Pretoria from Durban was open. The number of British troops in South Africa by the middle of the year was about 250,000.

Shortly after the middle of May (1900) news reached England that the Boers had been driven from Mafeking, and that the town had been entered by a British force from the south. The place had been invested from 15 October, when Cronje with a force of some 9,000 men had marched to the attack. It was well supplied with stores, and this, together with the indomitable energy and fertility of resource shown by Col. Baden-Powell, who commanded the small garrison, enabled it to hold out against all attempts to capture it. A last attempt to take it had been made on 13 May by Commandant Eloff, a grandson of President Kruger. This not only failed, but the leader and a number of his men were themselves taken prisoners.

In the end of July an important success was gained in the Orange Free State (now called Orange River Colony) by Gen. Hunter, with the aid of Gens. Rundle, Clement, Bruce-Hamilton, Paget, and Macdonald. As the result of a combined movement, a force of some 4,000 Boers under Prinsloo was surrounded by the British troops, and forced to surrender with guns, horses, and wagons, the burghers being sent as prisoners to Ceylon. De Wet, with 2,000 men, escaped, as on various subsequent occasions.

Advancing eastward from the Pretoria district Roberts joined hands with Buller, and from his headquarters at Belfast issued a proclamation annexing the Transvaal to the British dominions (1 September). Previous to this Buller had forced the Boers from a strong position they had taken up near Machadodorp, and had thus effected the release of a large number of prisoners whom they had taken with them from Pretoria.

On 11 September President Kruger took refuge in Portuguese territory, and many of his compatriots followed his example, or scattered in different directions, having previously destroyed many of their guns, with vast quantities of ammunition and stores. Lord Roberts reported that there was nothing left of the Boer armies but a few marauding bands, but this view of the case proved premature. On 6 October Buller left the army for England; on the 20th President Kruger sailed for Europe on board a Dutch man-of-war. Lord Roberts left for home before the end of the year, handing over the chief command to Lord Kitchener.

The war had now entered upon what might be called the guerrilla stage, during which the activity and daring of such leaders on the Boer side as Botha and De Wet gave plenty of hard work to the British troops. Looking with confidence for support from their kinsmen in the Cape Colony and Natal, and still hoping for the intervention of some European power, the Boer

Digitized by Google

1. Missionaries Baptizing a Kaffir Child.
2. The Inhabitants of a Kraal taking part in a Wedding Dance.

Digitized by Google

Digitized by Google

leaders planned two enterprises which they thought might yet retrieve their cause. Botha, with some 6,000 men, was to make a sudden dash into Natal, and raid the country, if possible, all the way down to Durban, while De Wet was to execute a similar movement in the direction of Cape Town. These attempts were made in the early part of 1901. Botha's plan was completely frustrated by a great sweeping movement of Gen. French; the Boers were dispersed with the loss of guns, wagons, and immense numbers of cattle and sheep. De Wet fared no better but, like Botha, he himself escaped capture, though losing guns, ammunition, and wagons. Marauding bands that had belonged to his force managed, however, to enter the Cape Colony, and for a time gave much trouble, aided and encouraged as they were by their Dutch friends. To checkmate the Boer system of warfare Kitchener resolved to clear the country of food and cattle so as to deprive the Boers of supplies, to protect the railways by chains of blockhouses, to carry similar chains across the country in suitable directions, and to keep the Boers perpetually on the move by mobile columns of British troops. Kitchener's measures, which were found exceedingly effective in the long run, included the gathering together of great multitudes of Boer women and children into the so-called concentration camps, a measure widely discussed and much condemned in the press of neutral countries.

A discussion regarding terms of peace took place between Lord Kitchener and Gen. Botha on 28 March 1901, but nothing came of it; the gradual wearing down of the Boers went on, and by the end of May they had lost practically all their artillery (apart from guns buried in the earth). On 12 July the Free State government and some important papers were captured at Reitz, and President Steyn himself made a narrow escape. On 7 August Kitchener issued a proclamation calling for the surrender of the Boers by 15 September, on pain of the perpetual banishment of the leaders, and of the property of the others being charged with the cost of maintenance of their families in British hands. The Transvaal and Free State leaders had been discussing the advisability of giving in, but President Kruger, from Europe, urged them to continue fighting till their independence was secured. Renewed activity on the part of Botha, De Wet, and other Boer leaders followed, and the British met with one or two rather serious mishaps. By the end of the year 1901 there had been put out of action some 53,000 Boers, of whom over 40,000 were in concentration camps, or were kept in custody in St. Helena, Ceylon, India, Bermuda, or elsewhere. After some great "drives" organized by Kitchener and carried out in the early part of 1902, which resulted in the surrender of many burghers, and which owed their success largely to the blockhouse system, negotiations for peace were at last entered on (23 March), though military operations were not suspended. The Boer leaders were granted facilities for meeting and discussing matters among themselves and with the different commandoes, and after this had gone on for some time, on 15 May a conference of Boer representatives met at Vereeniging to consider terms of surrender. It was not till the last day of the month, however, that peace was absolutely secured, the surrender being signed at Pretoria by Lords Kitchener and Milner and the chief civil and military representatives of the Boers, and the war thus brought to an end. The main points agreed upon were: that the Boer forces would immediately lay down their arms and hand over all guns, rifles, and munitions of war; that burghers in the field outside the Transvaal and Orange River Colony, and all prisoners of war outside South Africa, on declaring their acceptance of the position of subjects of Edward VII., should be brought back to their homes as soon as transport could be provided and their means of subsistence secured; that no proceedings civil or criminal should be taken against burghers so surrendering or returning, for acts done in connection with the war, unless as regards acts contrary to the usages of war; the Dutch language to be taught in public schools where parents desire it, and to be allowed in courts of law; the possession of rifles to be allowed to persons requiring them for protection, on taking out a license; military administration to be succeeded as soon as possible by civil administration, and ultimately representative institutions and self-government; a sum equal to $15,000,000 to be granted for the purpose of assisting in the restoration of the people to their homes, besides advances on loan free of interest for two years.

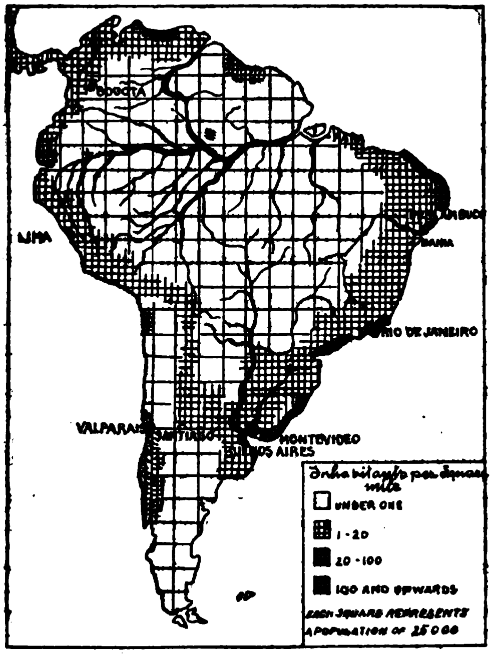
In this struggle there had been engaged on the British side at one time or another, or sent to the seat of war as reinforcements, from the outbreak of war until the conclusion of peace, 448,435 men of all arms, including 228,171 regulars, 45,566 militia, 35,520 yeomanry, 19,856 volunteers, 7,273 South African constabulary, 18,229 regular troops from India, 29,000 colonial contingents, 52,414 raised in South Africa. Of these 518 officers and 5,255 men were killed, 1,851 officers and 20,978 men were wounded, 554 officers and 15,617 men died of wounds or disease. How many men the Boers had in the field from first to last, including the rebels belonging to Cape Colony and Natal, will probably never be known. The number has been estimated by competent authorities at 60,000 to 65,000. The Boer casualties have never been definitely ascertained. Consult: Davis, 'With Armies in South Africa'; Barnes, 'The Great War Trek'; Doyle, 'The Great Boer War'; Cunliffe, 'History of the Boer War'; Amery, 'The Times History of the War in South Africa.'

South Amboy, N. J., borough in Middlesex County, at the mouth of Raritan River and the head of Raritan Bay, and on the Pennsylvania, the Central of New Jersey, and the Raritan River R.R.'s; 20 miles south of Newark. It was founded in 1835, and became a borough in 1888. It is important as a shipping point for coal, and has terra-cotta works, clay and sand pits, and asphalt works; there is a national bank with a capital of $50,000. The most notable public building is the borough hall; and there are two public schools and a Roman Catholic parish school. The government is vested in a mayor, and a council of six; two members of which are elected each year for a term of three years. Pop. (1910) 7,007.

M. N. Roll,
Editor of 'Citizen.'

Digitized by Google

South America, a continent, joined to Central America at about lat. 8° N., lon. 77° 15′ W. by the Isthmus of Darien, the boundary line between Colombia and the new republic of Panama being taken as approximately the limit of South America on the northwest. That line is nearly due south of Washington, D. C. The westernmost point on the South American coast is directly south of the peninsula of Florida; both the extreme northerly point, projecting into the Caribbean Sea, and, at the extreme south, the archipelago of Tierra del Fuego, adjoin 70° W., the longitude of Cape Cod, Mass. Thus we see that the Pacific coast and half of the Caribbean coast of South America lie exactly south of the Atlantic coast of the United States. But a relatively small part of the great equatorial mass



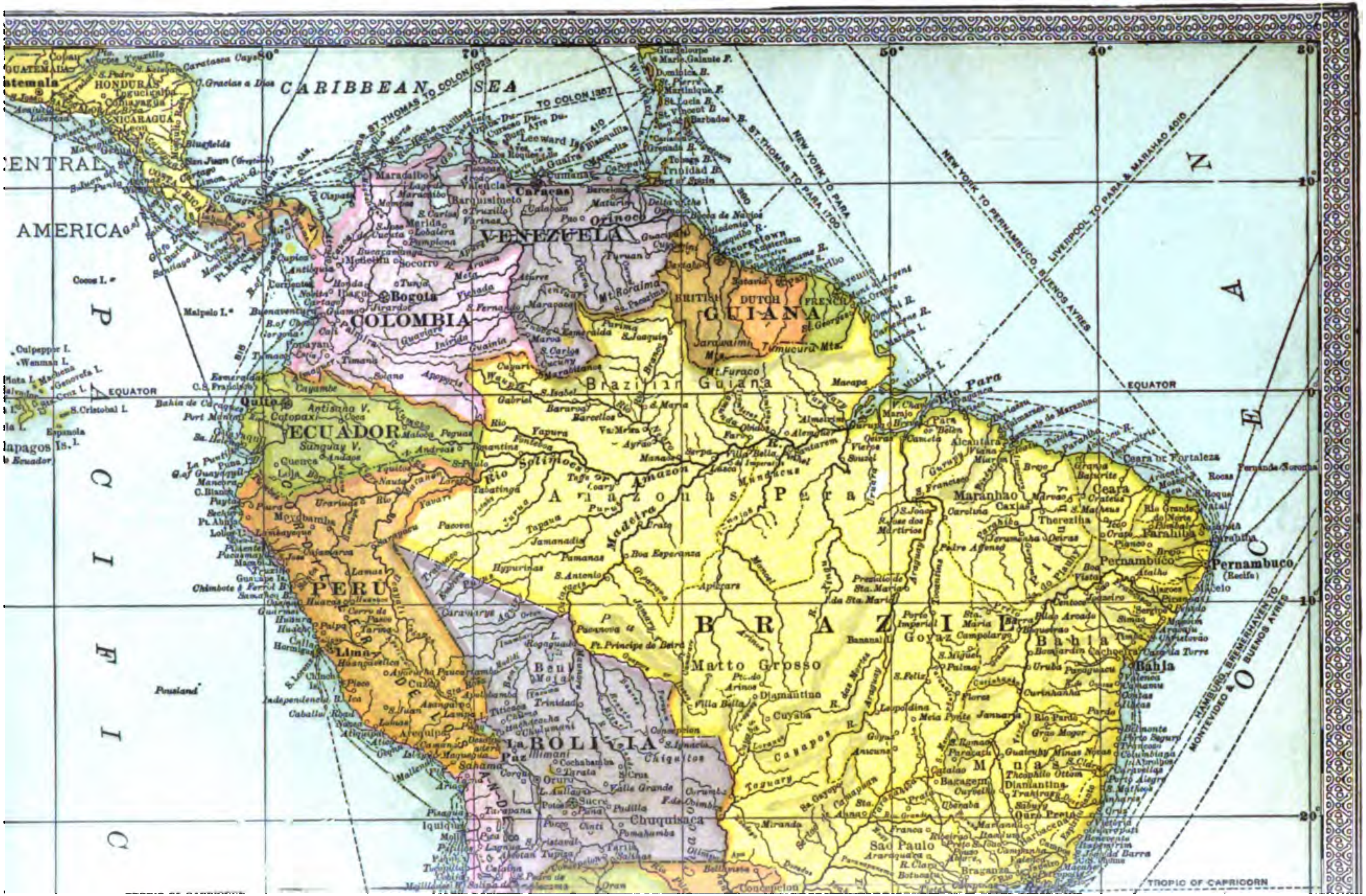
South America: — Density of population and principal river systems; showing opportunities for internal communication by water routes.— River systems drawn by Mr. Wilcox, author of this article.

between lat. 10° N. and lat. 25° S. is west of 70°. Pernambuco, Brazil, is situated so much farther toward the east (the width of the continent there being about 3,000 miles) that the sailing distance from that important port to the coast cities of Spain and Portugal is less than to New York. For all purposes of social intercourse, trade, and communication in general, the eastern and western coasts below the equator are much more easily reached from Europe than from the great centres of population in the United States. Some of the sailing distances are given as follows: Pará to Lisbon, 3,248 miles; Pernambuco to New York, 3,696 miles; Pernambuco to Plymouth, England, 3,867 miles; and in a later paragraph it will be shown that the superior facilities for transportation and direct intercommunication between Europe and these ports below the equator have hitherto accentuated this slight advantage, or, let us say, converted into marked advantage a virtual equality in geographical situation.

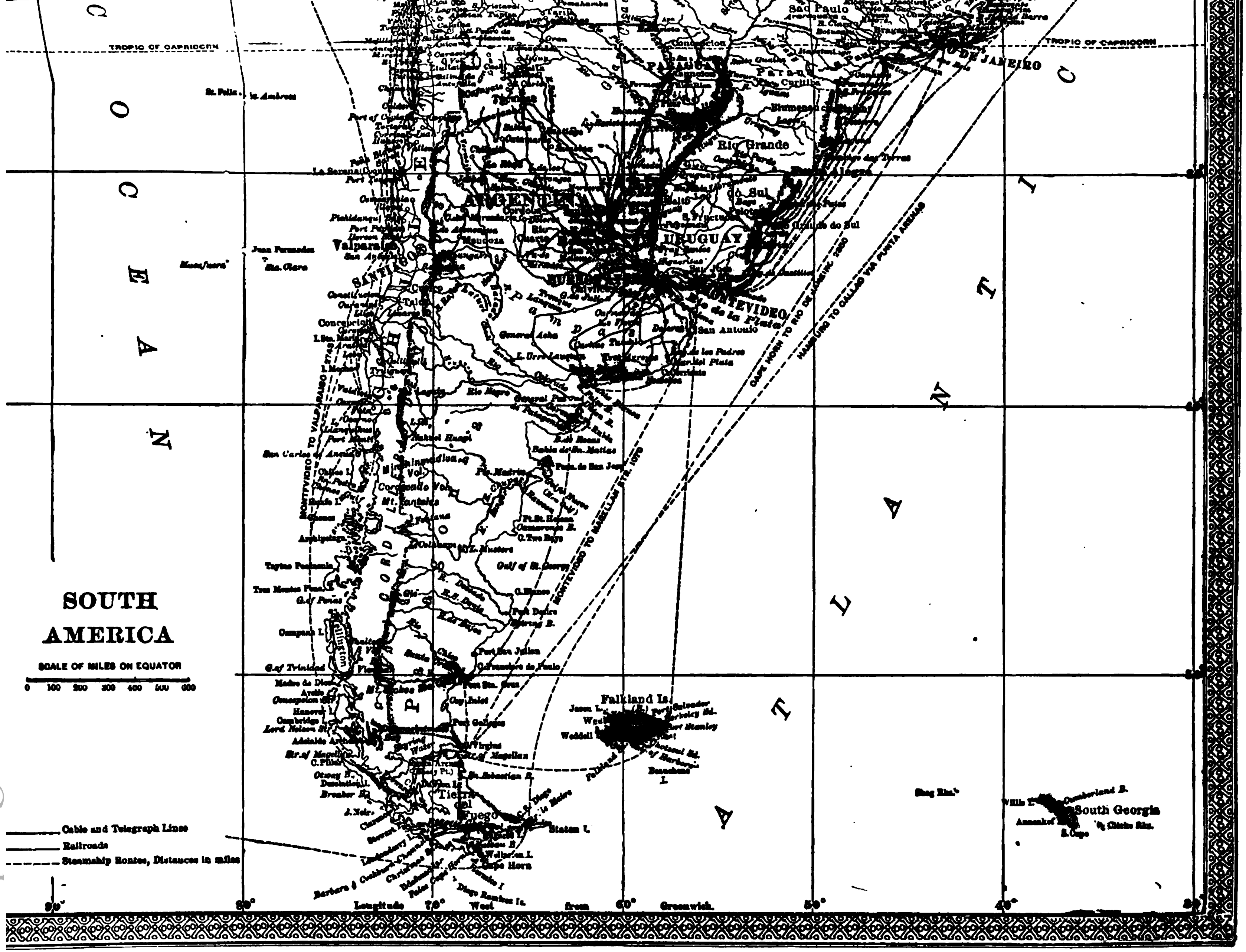
The natural avenues of internal transportation and communication are the great rivers which pierce the continent from the east, northeast, and southeast — avenues still waiting to be improved and fully utilized. The accompanying sketch-map shows the main river-systems: that of the Amazon (including the Madeira, Negro, etc.), draining the central regions and the farthest west, even the Pacific coast range in Peru (q.v.) and the cordillera of the Andes in Colombia and Bolivia; that of the La Plata (Paraná, Paraguay, and Uruguay rivers), also draining the centre and west, though reaching far toward the east for two of its chief sources of supply, and pouring its enormous stream into the Atlantic beyond Buenos Ayres and Montevideo; that of the Orinoco, uniting in itself many rivers of the northwest and north, and entering the ocean near the boundary of British Guiana and Venezuela; that of the Tocatins (Tocatins and Araguay rivers), merged in the Pará estuary below the Gulf of the Amazon; that of the São Francisco, rising in the mountains north of Rio de Janeiro and reaching the ocean between Bahia and Pernambuco; that of the Magdalena and Cauca in Colombia, etc. The heavy lines on the small map just referred to have been drawn with the design of conveying at a glance an impression which should be in agreement with the records of four centuries of exploration — the impression, namely, that in the vast central regions, where the inhabitants number less than one to the square mile (as the map also indicates), the courses of great rivers lie side by side, approaching each other so nearly, certainly in some, and probably in many localities, that they furnish almost continuous waterways between the northwest and the southeast, the lower departments of Colombia and Buenos Ayres. Between the Atlantic and Pacific, through the broad part of the continent, continuous water routes, east and west, northeast and southwest, extend to the foot of the Andes, and in one noteworthy instance beyond all except the oldest ridge in the Andean cordillera (see below: *Geology*). With very good reason, therefore, the subject of inland communication, not partial but complete, between the Amazon and La Plata river systems has interested geographers. A map made by Petrus Koerius (Keer) in 1614 shows the Paraná system united in central Brazil with branches of the Amazon and Rio São Francisco, the source of all three being a large lake (lat. 15° S. and lon. about 52°–53° W.). The same lake appears as Eupana Lacus on the maps of Josse Hond, dated 1606, P. Bertius, 1616, Van Langeren, 1630, and C. de Jonghe, 1640. Though still called Lake Eupana, it is transferred to a position midway between the Atlantic and Pacific oceans; made the source of the Paraguay River, and also connected with the Madeira, in the map by Nicolas Sanson, dated 1650. In Pierre du Val's map of 1655–65, it figures as a widening of the Paraguay River near the boundary of Peru; and it was similarly represented by Guillaume Sanson in 1679. It is called Lago de los Xarayes in M. Coronelli's map, dated 1688. Guillaume de l'Isle in 1700 set it down, and he also named it Lago de los Xarayes; but in a map by the same hand, dated 1703, the lake has dwindled to a "laguna." Nicolas de Fer, in his map, dated 1705, restores the lake to its former

Digitized by Google

Digitized by Google



Digitized by Google



Digitized by Google

Digitized by Google

great size, and indicates by dotted lines the general belief that it communicated with the Amazon and the São Francisco, beside supplying the Paraguay. In our own day some atlases give an enormous «Marsh of Xarayes» on the upper reaches of the Paraguay River, with a smaller lake; and the constitution of Brazil provides for the location of the future capital of that republic near the point of divergence of great rivers flowing north, east, and south, where the old geographers placed the original Lake Eupana (see GOYAZ). Probably the 17th century maps offer the best solution of the problem of securing regular communication between the centre of the continent and the Atlantic ports. Lakes which have vanished or shrunken, simply because their natural barriers have been worn away, can be re-created; and little or no canalization would be required there, though obstacles to navigation in the lower river-courses must be overcome. One of the trustworthy things in all the central part of South America is the rainfall. It is certainly possible to store the rainfall; to dam up the ineffective rivers and rivulets at some central point, so that an inexhaustible capital (in the true sense of the word) may be rendered available — a fund of waters which can be directed into the best natural channels, for the development of that mode of transportation in respect to which the fertile desert of South America above the tropic of Capricorn can be made to excel all other inland regions, of either hemisphere.

In the country north of the Amazon, a navigable route between the Orinoco and the Amazon's widest northern tributary, Rio Negro, already exists as a natural canal or connecting stream, the so-called Cassiquiare River; but unfortunately rapids obstruct navigation on both the Orinoco and Rio Negro between the Cassiquiare and the ocean. The Amazon's greatest tributary, the Madeira River (itself as opulent in water as the Mississippi) is navigable by large steamers from its mouth to 8° 45′ S. Between the latter point and 11° S. there is a series of cascades, extending to the confluence of the Mamoré and Beni rivers, and on the former still 50 miles farther toward the south. Were it not for these cascades, the Mamoré, Beni, and Madre de Dios rivers (forming the tripod shown on the small map) would furnish a most convenient outlet for the products of the Bolivian Sierra and southeastern Peru. It is understood that Brazil has agreed to maintain a railway, running from a point on the Madeira below the obstructions to lat. 11° S. on the Mamoré, thus enabling Bolivia to make use of the northeasterly waterway to the Atlantic Ocean. Explorations of the Pilcomayo and Bermejo rivers, which also rise in the Bolivian highlands, but unite with the Paraguay, have not as yet given definite results. On the other hand, practicable routes have been discovered, for steamboats of moderate size, between the interior of Colombia and the Amazon. This important subject will be referred to again in the present article, under the sub-title *Railways and Navigation.*

For estimates of the areas of the South American countries; also for their mineral resources, agriculture, manufactures, weights, measures, and money, banks, governments (including the judiciary and the local governments), finances (revenues, expenditures, and public debts), armies and navies, population, educational systems, religion, etc., see the special articles devoted to each of the South American republics and Guiana, Education in Latin-America, and Spanish-American Literature. For climate, flora, fauna, and further comments upon physical geography and hydrography, see the same special articles and the general article AMERICA.

Political Divisions.— South American republics are: Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Paraguay, Peru, Uruguay, and Venezuela. Geologically, Panamá belongs rather to the Central American (Antillean) continent. Dependencies of European countries on the South American mainland are the three Guianas — British, Dutch, and French.

Geology.— Charles Darwin writes, in his 'Journal and Remarks' (see *Bibliography*) under date of 21 March 1835, that the Andean cordillera in Chile «consists of two principal ranges, the passes across which attain respectively an elevation of 13,210 and 14,365 feet. The first great line . . . is called Peuquenes . . . To the eastward, a mountainous and elevated region separates it from the second range (called the Portillo) overlooking the Pampas. The streams from the intermediate tract find a passage . . . through this *second* line.» Mr. Darwin then gives «a very brief sketch of the geological structure of these mountains,» and reaches the conclusion «that the Peuquenes existed as dry land for a long period anterior to the formation of the second range.» He adds, «I will only make one other geological observation: the Portillo chain in the neighborhood of the pass is rather more elevated than the Peuquenes, yet the waters of the intermediate district have burst a passage through it. On the supposition of a subsequent and gradual elevation of the second line, this can be understood; for a chain of islets would at first appear, and as these were lifted up, the tides would always be working out deeper and broader channels between them.» He also refers to «an hydrographical phenomenon of a nearly similar kind, but on an infinitely grander scale, which occurs in Bolivia»— namely, the escape of rivers through such an immense mountain-mass as the Bolivian Cordillera — and observes that «excepting through the explanation above offered, the circumstance that rivers flowing from a less elevated chain should penetrate one far more lofty appears to me quite inexplicable.» It seems probable — indeed, quite certain — that Mr. Darwin would have been willing to extend the same process of reasoning to the «hydrographical phenomenon» presented by the Marañon River, which flows northward about 350 miles in Peru between the maritime and central Cordilleras, confined both by the latter and the enormous eastern chain, or Andes proper, but finally escapes in an equally impressive fashion and straightway begins its long easterly course to the Atlantic. We must hold, then, that in Peru the maritime Cordillera is much older than the central and eastern chains; that while the latter were being gradually lifted up the easterly trend of the Marañon was already marked out; and the conclusion is inevitable that the parent stream of the Amazon is the Marañon, for clearly this distinction cannot be accorded, as so many travelers and geographers have sought to prove that it should be, to the Ucayali or some other

Digitized by Google

river, formed on the more recent eastern Andean slopes and sooner or later uniting with a current which must have existed «for a long period.» Another deduction from Mr. Darwin's «geological observation» is this: The Andes Mountains, «wringing from the vapor-laden trade-wind,» as has been well said, the last particle of moisture that their snow-peaks can extract — and by this means creating so many large rivers — are not to be regarded as at all points an insurmountable double or triple barrier between the Pacific ports and the interior. On the contrary, the more recently formed heights, overlooking the Montaña (see PERU), still show, here and there, «deep and broad channels (valleys) between them.» See also CORDILLERA.

Commerce.— The causes which have been pointed out in the opening paragraph — the facts (1) that South America is in reality, from the point of view of inhabitants of the United States, southeastern America, and (2) that the eastern and western coasts below the equator are, for the reasons given, much more easily reached from Europe than from the great centres of population in the United States — produce effects which should have been foreseen: a large part of the southeastern continent receives its ideas, manners, fashions, and culture from Europe, and, of course, bestows its trade in the same quarter. The commerce of all the republics and European dependencies in that part of the world has been most thoroughly analyzed and fully stated in publications of the Treasury Department and Department of Commerce and Labor, of the government of the United States, and in the bulletins and handbooks of the International Bureau of the American Republics; to all of which the reader is referred for a more detailed account than can be given in this article. It is especially interesting to compare the views expressed in a Treasury Department publication entitled 'American Commerce' (from the summary of commerce and finance for June 1899) with the opinions on the same subject entertained at Washington after the lapse of more than four years, in January 1904. Tables in 'American Commerce' show that imports into the United States from South America in 1850 were valued at $16,034,009, and in 1899 at $86,576,020, the maximum in any year during a half century being $150,727,759 in 1892. The exports from the United States to South America in 1850 were valued at $7,715,005, and in 1899 at $35,660,932, the highest point reached in the same period being $38,752,648 in 1890. The relation which these figures bear to the entire South American foreign trade is the subject of the following comments: To Colombia, the United States supplies 33 per cent of the total imports for consumption; to Venezuela 27 per cent; to British Guiana 25 per cent; to Dutch Guiana, 17 per cent; to French Guiana, less than 6 per cent; to Brazil (in 1897), about 12 per cent; to Uruguay, Argentina and Paraguay, less than 7 per cent; to Chile, Peru, Bolivia, and Ecuador (average), about 10 per cent. «Thus the northern coast of South America, fronting on the Caribbean Sea, imports goods to the value of $36,000,000, of which we supply an average of 25 per cent; the eastern coast, fronting upon the Atlantic, $222,000,000, and the Pacific Coast, $51,000,000 of which our proportion is in each case about 10 per cent.» Furthermore, «An examination of our list of purchases from the Central and South American countries seems to increase the anomaly presented by their small purchases from us. From the countries of South America fronting upon the Atlantic and Pacific, the United States, in 1897, purchased goods valued at $88,408,119, while her sales to them in that year were but $24,480,013, or less than one third of her purchases from them; in 1898, in spite of the fact that to the whole world our sales were double the amount of our purchases, those to the South American countries beyond the Caribbean Sea were still but about one third of the amount of our purchases from them. It is thus apparent that the United States is not making satisfactory progress in her commerce with the American countries lying at the south. . . . To the countries bordering upon the Caribbean Sea, between whose ports and those of the United States there is comparatively frequent steamship communication, the growth of exports has been fairly satisfactory; but to that great stretch of country south of the easternmost point of South America, and extending around Cape Horn and up the entire western coast, conditions are not only unsatisfactory, but apparently growing more so each year.» Among the numerous explanations of this anomaly, the following were emphasized at that time (1899): «When it is considered that nearly all of the steamship lines entering the ports of South America are controlled by European capital and European interests, it is not surprising that a large share of the commerce of those countries should be diverted to Europe. Naturally a considerable share of their exports goes direct to Europe, and to that extent it would be quite reasonable to expect that their purchases would be from that part of the world. The fact that the exports from the United States to Europe greatly exceed the imports from Europe makes it practicable for vessels which bring the rubber, coffee, hides, and wool of South America to the United States to load at our ports with grain or provisions for Europe, and there load again with goods for the South American markets, thus making the tour of the triangle, of which the line from New York to Liverpool forms the base and the ports of Brazil and Argentina the apex. That this should occur . . . with lines of steamships controlled almost exclusively in the interests of European capital and European trade is to be expected. Added to this is the lack of banking and business facilities for direct intercommunication with the United States, neglect of American merchants to study the trade methods and requirements of the countries in question,» etc. The well intended, but actually somewhat misleading, suggestion was offered: «With a ship canal, vessels from the United States would pass in an almost direct line from her eastern and southern ports to all the west coast of South America, and bring the United States into direct communication with that section of South America located within the temperate zone, where railway systems, production, and commerce are now so rapidly developing. With the completion of 46 miles of the railway line between Valparaiso and Buenos Ayres, goods from the eastern and southern ports of the United States would find a direct route through the isthmus, along the western coast of

Digitized by Google

South America, and by rail through Chile to Argentina, Uruguay, and the most densely populated and productive section of Brazil, instead of being compelled, as at present, to make a detour of 2,600 miles to pass the easternmost point of the South American continent.» (From 'American Commerce,' page 3174.) Now, between 1899 and 1904 there has been certainly very little in the general drift of the South American policy of the government of the United States or in the enterprise of private citizens to justify the expectation of a change so extraordinary as would be the complete reversal of an unfavorable current of trade which has grown steadily stronger, «more unsatisfactory each year,» through at least a half century; nevertheless there are notes of surprise and almost querulous complaint in comments published in 1904, which are based simply upon a fresh observation of inveterate tendencies. The following quotations, for example, illustrate both that spirit and some features of the most recent statistics of the South American foreign trade, which unquestionably deserve to be studied with the utmost care: «From no point of view is it possible to regard the sales of products of the United States to South America as other than utterly inadequate and unsatisfactory. Their total is (that is, averaged during the decade 1893-1903) a little less than $40,000,000 a year. . . . Taking sales and population, our trade with the South Americans approximates $1 per capita. We sold to the Canadians in 1903 nearly $24 per capita, and to the Cubans about $15 per capita. The total imports of all the South American countries approximate $350,000,000. We get a fraction more than 10 per cent of their business. This is not because they have nothing that we want in exchange for our wares and merchandise. We buy from them three times as much as we sell to them. We pay them about $120,000,000 a year for their products, and they take $80,000,000 of it and go to our business competitors and buy the very merchandise in which we ought to settle our accounts with them. . . . The particularly noticeable feature in our trade with South American is its comparative fixity. In 30 years it has increased only 50 per cent, and the sales of 1890 were about the same as those of 1902. Compared with the trade of 1873, our 1902 trade with the world outside of South America was a little more than doubled. With Asia it rose from $19,000,000 to $64,000,000. With Oceania it rose from $4,677,000 in 1873 to $34,250,000 in 1902. With Africa it increased from $3,500,000 to $33,500,000. With our neighbors on the North American continent it has increased from $82,000,000 in 1873 to $204,000,000 in 1902. During those 30 years our vast trade with Europe has been doubled. More than that of any other of the world's divisions our trade with South America drags. . . . In the last 30 years we have bought from that region $1,700,000,000 more than we have sold to it by direct exportation.» (See also EXPORTS AND IMPORTS OF LATIN-AMERICA.) The South American trade conditions which were observed in 1899 reappear, accordingly, in 1904, unchanged in their general aspect, or with the subordination of North American commercial interests somewhat intensified. Moreover, reliance upon the proposed isthmian canal alone, as the means of revolutionizing such conditions, appears from the following figures to be unwarranted: The sailing distances from New York and New Orleans to Panama will be (via isthmian canal when constructed), respectively, more than 2000 miles and more than 1,400 miles; from New York to Valparaiso, 4,630 miles (compare the distance from San Francisco to Valparaiso, namely, 5,140 miles). The distance overland from Valparaiso to Buenos Ayres is about 750 miles, and the unfinished railway in part is a narrow-gauge road crossing the Andes at an elevation of 10,500 feet. Thus the total length of the route anticipated in 'American Commerce'—by the isthmian canal and the Buenos Ayres and Valparaiso Trans-Andine Railway — is about 5,380 miles. But the regular course of steamships between Spain and the Rio de la Plata (q.v.) is less than 5,200 nautical miles; between German ports and the same estuary about 6,000 nautical miles; and other distances are as given in the first paragraph. A fact of political as well as economic significance is thus sufficiently indicated: Even after the completion of the isthmian ship canal and the mountain link of the railway between Chile and Argentina, the entire eastern coast below French Guiana will continue to be more accessible from Europe than from the United States. Logically, this observation applies with equal force to all of the interior regions, so far as their future development depends upon the utilization and improvement of the chief inland water routes which issue, at widely separated points, on that same stretch of Atlantic coast. See also the articles PARAGUAY, SÃO PAULO, BRAZIL, MONTEVIDEO, URUGUAY, ARGENTINA, etc., for comments on immigration, which is steadily effecting the more thorough Europeanization of the whole territory south of the equator and east of the Andes.

Railways and Navigation.— The committee on the Intercontinental Railway (q.v.), or Pan-American Railway, at the second international conference of American states, received reports from the delegations to the conference, in response to a request for information as to the railway lines in operation, under construction, and contemplated in the different countries represented. The total length of the South American railways in 1901, as shown by those reports, was: In Argentina, 17,062 kilometres; Bolivia, in service, 925 kilometres, and in process of construction from Lake Titicaca to La Paz, 125 kilometres; Brazil, 998 miles broad gauge (1.7 yards), 7,742 miles of 1.09 yards gauge, and 551 miles of four fifths of a yard gauge, the total length of line «under traffic» being given as more than 10,000 miles; Chile, 4,486.5 kilometres in actual working; Colombia, 418 miles (but that, of course, included the 47.5 miles from Panama to Colon); Ecuador, in process of construction, the Guayaquil and Quito railroad, which «will traverse a distance of 300 kilometres, more or less»; Paraguay, «about 350 kilometres»; Peru, «in exploitation,» 955.89 miles, almost all narrow gauge; Uruguay, «for each square kilometre of surface of land, 10 metres of railroad line,» the total length, including the lines unfinished at that time, being 2,633 kilometres. In 1899 there were 529 miles of railway in operation in Venezuela, a country unrepresented in the report of the committee. Of uncommon interest is the suggestion offered to the committee by General Rafael Reyes, the

Digitized by Google

Colombian explorer, that "the intercontinental railway line, which will cross Colombia" — or, if the realization of that project has been made more difficult by recent events in his country, then any other well equipped line from the west — "can be connected with the immense system of river communications," which he describes, giving, in part at least, results of his personal observations (compare 'Report of the Pan-American Railway Committee to the Second Conference of American States, held in the City of Mexico, 1901–2': Washington, 1902).

In his own words, "These rivers run through the territory of all the South American countries, with the exception of Chile, in such manner that either they communicate with each other already, or connection can be supplied between them. During several years I explored, in company with my brothers, Henry and Nestor, who perished in that work, the Amazon River and the greater part of its affluents; we discovered some unknown rivers; we established steam navigation in others. In many of the rivers which at that time were unknown, to-day there are hundreds of steamers, which carry industries and civilization to the virgin forests. The exportation which to-day is made by way of those rivers, of rubber alone, which grows wild in the forests, is worth more than twenty million dollars in gold. In those forests there grows in abundance the wild cacao, which is now being exported in considerable quantities, and all classes of fine woods and medicinal plants are also abundant. Game of all kinds is found, and in the waters are more than 500 species of fish, which form a very important article of trade. The extent of the territory that these rivers irrigate is more than 4,000,000 square miles, which are still virgin soil, and which are offered to commerce and to human industry." General Reyes gives the names of the principal rivers in the Amazon and Orinoco systems, and the extent of their navigable waters, as follows: In Brazilian Guiana, the Trombetas, for steamers, 200 miles; in Venezuela and adjoining territory, the Orinoco, with its affluents (the Meta, Arauca, and Vichada), and the Rio Negro and Cassiquiare, combined, more than 1,000 miles; in Colombia, the Putumayo (with free navigation for steamers during the whole year), 1,200 miles, and the Caqueta or Yapura, rising in Lake El Buey, which is also the source of the Magdalena system, and flowing 1,600 miles, of which 1,300 are navigable for steamers; in Ecuador, the Napo, rising east of Quito, navigable for steamers 800 miles, the Patasa and the Tigre, navigable for steamers respectively 500 and 300 miles; in Peru and adjacent territory, the Morona (200 miles, river steamers), Guayaga or Huallaga (300 miles, river steamers), Ucayali (600 miles, river steamers), Yurua (700 miles, river steamers), Yavari (900 miles, river steamers), and the Marañon or Amazon, which has a course of more than 4,100 miles, navigable by trans-atlantic steamers 3,000 miles (there being two direct lines of steamers running from Liverpool to Iquitos, in eastern Peru), and by river steamers 3,400 miles; in Bolivia and adjacent Brazilian territory, the Purus, navigable for steamers 1,500 miles, and the Beni and Madre de Dios, "which can easily be connected with the [navigable portion of the] Madeira," the latter being navigable for steamers 1,000 miles; in Brazil (besides the lower course of the largest rivers and the main body of the Amazon), the Xingu, navigable for steamers 600 miles, and the Tocatins, navigable for steamers 500 miles. The last mentioned river passes "at the port of Sierra Esclavana" only a few miles from the river Alto de la Plata or Paraná, "with which it could be connected by means of a railway or of a canal, and thus the navigation in the currents of the river de la Plata could be united with the immense volume of water of the Amazon." The total extent of the navigable waters of the foregoing rivers, General Reyes gives as 16,000 miles (compare the estimate given in the 'Encyclopædia Britannica:' "Probable extent of navigable waters" of the Amazon, 50,000 miles; of the Orinoco, 8,000 miles).

Ethnology.— In the articles devoted to each of the Latin-American countries, and in EMANCIPATION IN LATIN-AMERICA, INCA SEMI-CIVILIZATION, etc., some intimations are conveyed of the essential differences between the several communities in respect to the component elements of population. Each South American country must be studied as a separate problem. Professor Latané, in his 'Diplomatic Relations of the United States and Spanish America,' writes: "It should be borne in mind that in Spanish America the native Indian races were not driven beyond the frontier of civilization, as they were by the English settlers, but became and remain to this day an integral part of the population. There was thus in the Spanish colonies an unusual admixture of races. There were (1) European Spaniards; (2) Creoles, or children born in America of Spanish parents; (3) Indians, the indigenous race; (4), negroes, of African race; (5) Mestizos, children of whites and Indians; (6) mulattoes, children of whites and negroes; and (7) Zambos, children of Indians and negroes." This may be taken as a convenient generalization to serve as a starting point; and it is evident that the next steps beyond it should lead us to examine (1) the distinguishing and by no means identical characteristics of the Spanish and Portuguese ruling classes — the latter mainly in Brazil; (2) the varying proportions in which the white, Indian, and negro components are found; (3) the exceedingly important matter of immigration from Europe and the Orient; and (4) the physical and moral characteristics of the Indian element, since we must sometime awaken to the fact that members of different native races are quite as unjustly treated, when they are forced against nature into a single class or category, as citizens of different European countries would be if sweeping generalizations were in the same reckless way applied to them. A valuable suggestion in regard to the disappearance of great numbers of the inferior, constitutionally feeble Brazilian indigines (and this reasoning may partially explain the fate of some other South American and West Indian tribes as well) is offered by Dr. J. Hampden Porter, who writes: "Despondency, to which these natives yield without a struggle, acts as it never could do among men who had any mental or physical stamina. . . . Despondency or despair has played so conspicuous a part in this country [Brazil] as the cause of death among natives subjected to foreign rule that its modus operandi has received all kinds of fanciful explanations. . . . In re-

Digitized by Google

viewing Brazilian tribes with regard to their alimentation, acclimatization, hygiene, etc., some light may be thrown upon those conditions which produced so great a mortality under emotional stress. . . . Spanish and Portuguese taskmasters never understood how men more vigorous in appearance than their own peasantry could die from exertions to which the latter would have been fully equal, and still less did these strangers comprehend that innutrition was able to make mental depression as deadly as the worst forms of epidemic disease.» (From the chapter 'Native Races,' in 'United States of Brazil: A Geographical Sketch': Washington, 1901). The interesting character of Dr. Porter's conclusions can be appreciated if we compare studies of similar conditions in other fields — for example, in Porto Rico (q.v.)

History.— See DISCOVERIES OF AMERICA TO 1542, SPANISH AND PORTUGUESE; AMERICA; DABAIBA; ELDORADO; DAVILA; BALBOA; CHIBCHAS; INCA SEMI-CIVILIZATION; COUNCIL OF THE INDIES; DEMARCATION, LINE OF; DUTCH WEST INDIA COMPANY; EMANCIPATION AND DECLARATIONS OF INDEPENDENCE IN LATIN-AMERICA; BOLÍVAR; DICTATORSHIPS IN LATIN-AMERICA; GUIANA; and articles on each of the ten republics — sub-titles 'History' and 'Government.' In the following paragraph only a few additional topics will be briefly mentioned, with the object of completing the outline sketch of the history of South America up to the point at which it seems best to refer the student to works which deal liberally with the same, or related, topics.

The participation of English-speaking persons in the South American struggle for independence is described in Lord Cochrane's account of his own services, and in 'Diplomatic Relations of the United States and Spanish America,' by Prof. John H. Latané. Foreign officers — Europeans (not Spanish) and North Americans — who served in the patriot armies of Chile and Peru between 1817 and 1830 numbered 67, of whom 21 were killed and 18 wounded. Very interesting are the following passages in a letter which Rufus King, the American minister to England, wrote to his government on 26 Feb. 1798: «Two points have within a fortnight been settled in the English cabinet respecting South America. If Spain is able to prevent the overthrow of her present government, and to escape being brought under the entire control of France, England will at present engage in no scheme to deprive Spain of her possessions in South America. But if, as appears probable, the army . . . or any other means which may be employed by France shall overthrow the Spanish government . . . *England will immediately commence the execution of a plan long since digested and prepared for the complete independence of South America.* If England engages in this plan, she will at Philadelphia propose to the United States to coöperate in its execution.» That communication was never made; or, rather, if such a conspiracy was ever proposed, no record of it has been brought to our notice. Mr. Latané writes: «Thirty years before the Spanish colonies began their war of independence, the British government had entertained the idea of revolutionizing and separating them from Spain. This idea . . . was frequently agitated (after 1779) with the avowed object of opening up South America to British commerce.» Of the patriot Miranda, Bolivar's forerunner, it is said that «Arriving in New York from England in 1805,» Miranda went to Washington and laid his plans before the administration, having informal conferences with President Jefferson and Secretary of State Madison. Upon his return to New York, he represented that he had secured from the government a secret sanction of his contemplated invasion of Venezuela. In 1806 he sailed from the United States with an «imperfectly equipped force of about 200 men.» Mr. Jefferson and Mr. Madison denied having in any way committed the government to Miranda's undertaking. The British goverment lent its encouragement, through Lord Cochrane, to the filibustering expedition from the United States to Venezuela, and also sent much stronger British forces, not «imperfectly equipped,» against the provinces of Río de la Plata. (See LA PLATA, RIO DE, and MONTEVIDEO.) The Argentine naval force, under command of an Irishman named Brown, on 16 May 1814 defeated and almost entirely destroyed the Spanish squadron stationed at Montevideo. Through its agent in London, the Chilean government secured the services of Lord Cochrane, who lent invaluable support to General San Martin in the campaign on the Pacific coast. The brilliant feat by which the Argentine leader made himself the liberator of the south, as Bolívar (q.v.) was of the north, is described by Mr. Latané in a sufficiently striking passage: «On 17 Jan. 1817 General José de San Martin began the passage of the Andes [from Argentina to Chile] with about 5,000 men, 1,600 horses, and 9,000 mules, the latter carrying the field artillery, ammunition, and provisions. The summit of the Uspallata Pass is 12,700 feet above sea-level, 5,000 feet higher than the Great St. Bernard by which Napoleon led his army over the Alps. In many other respects San Martin's achievement was more remarkable. Each piece of artillery had to be carried suspended on a pole between two mules, or, where the road was particularly dangerous, dragged by ropes. There were chasms that could be crossed only by cable bridges. The march over the Andes occupied three weeks. Both men and animals suffered greatly from *soroche,* the illness caused by rarefied atmosphere.» (See also ARGENTINA, CHILE, and PERU.) The Spanish colonies were regarded as possessions of the Spanish crown, rather than of the nation, on account of the nature of the grant by Pope Alexander VI., when establishing the Line of Demarcation. When King Charles IV. and Prince Ferdinand were compelled by Napoleon to renounce forever the crown of Spain and the Indies, the colonists claimed that they were «not politically a part of Spain, but connected only through the sovereign, and that with the removal of the sovereign the connection ceased.» The regency of Cadiz, of course, maintained the contrary in opinion and action; and by the close of 1815 the insurrections were suppressed everywhere but in La Plata. There the movement was beyond control, and then San Martin carried both force and inspiration across the Cordilleras into Chile, and later to Peru. In 'Harper's Weekly' (editorial, 'Japan and South America — a Contrast'), the writer of this article has said: «When the South American communities engaged in a struggle with Spain, dur-

Digitized by Google

ing the early years of the last century, their inhabitants, utterly lacking tuition, commenced to fight by intuition: they were in the position of people who had always been denied free intercourse with the progressive nations, and who were therefore totally unprepared to resist well-trained forces. Appeals for assistance were made in Russia, England, and the United States, and some private assurances of co-operation were obtained even before the first shot was fired. . . . Foreign volunteers were South America's teachers; through 20 years of heart-breaking warfare the Spanish-Americans made belated preparations to deal decisive blows; and when at last they had learned their lesson and were ready to begin, a single well-planned battle — that of Ayacucho — brought the great series of little contests almost to an end. Perhaps never before has it been so thoroughly demonstrated that wars with untrained contestants resembled the arguments of witless speakers — which are interminable, owing to the failure to see distinctly the vital points at issue, and lack of ability to attack them, winning or losing promptly.»

The practical impossibility, during the earlier stages of the evolution of the South American republics, of curbing the power of the presidents (so often dictators in all but the name, even when the obnoxious title has neither been accepted by them nor commonly applied to them) has been vigorously set forth by nearly all writers whose standards are found exclusively in the much more rapidly evolving United States. For the most important records of the struggles in the several communities to reduce the executive power to its due proportions in relation to the legislative and judicial branches of the government, and to the people themselves, we must search the texts of the national constitutions. For example, the bitterness of Paraguay's unparalleled experience has borne fruit in the constitutional provision (Article 13) that «Dictatorship shall be unlawful and inadmissible . . . and any one who may propose to establish it or [who] consents or subscribes to its establishment shall be held to be an infamous traitor to the country, and liable therefor to the proper penalties.» On the other hand, Colombia's misfortunes have not yet erased from her constitution Article 121: «In case of foreign wars or civil commotion the President may, after consultation with the Council of State, and with the written consent of all the ministers, declare the public order to be disturbed, and the whole or a part of the republic in a state of siege. After such declaration the President shall be invested with the powers which the laws confer upon him to defend the rights of the nation or to repress disturbances; and, in case the laws are defective, he shall use the powers conferred by the law of nations,» etc. It is to be said, however, that the dictatorial powers thus conferred are qualified in their bearing upon the negotiation of treaties by Title XI., Art. 120, x., and passages in other parts of the constitution. The recent emergence of one of the less progressive countries — the «voluntary» appearance of Venezuela «at the bar of that high court of international justice and international peace,» The Hague Tribunal — is characterized in the first article in the 'North American Review' dated December 1903. See also 'An Americanist's View of South American Problems' in the same review, 1904.

Bibliography (in addition to the works mentioned above).— Bates, 'Central America, the West Indies, and South America,' and 'The Naturalist on the River Amazons'; Cieza de Leon, 'The Travels of . . . A.D. 1532–50'; Darwin, 'Zoology of the Voyage of H. M. S. Beagle,' and 'Journal and Remarks'— the latter most conveniently issued in connection with Fitzroy's 'Narrative of Voyages of H. M. ships Adventure and Beagle'; Gillis, 'U. S. Naval Astronomical Expedition to the Southern Hemisphere During 1849–52'; Hettner, 'Die Kordillere von Bogotá'; Humboldt, 'Personal Narrative of Travels to the Equinoctial Regions of the New Continent during the years 1799–1804; 'Vues des Cordillères,' 'Examen Critique,' etc.; Mansfield, 'Paraguay, Brazil, and the Plate'; Marcoy, 'Journey Across South America'; Middendorf, 'Peru'; Musters, 'Unter den Patagoniern'; Orton, 'The Andes and the Amazon'; Réclus, 'Nouv. géog. univ.'; Rodney and Graham, 'Reports on Present State of United Provinces of South America'; Schomburgk, 'Travels in British Guiana'; Sievers, 'Venezuela'; Wallace, 'Narrative of Travels'; Wagner, 'Naturwissenschaftliche Reisen im tropischen Amerika'; Wappäus, 'Das Kaiserreich Brasilien'; Zöller, 'Die Deutschen im Urwald,' and 'Pampas und Anden.'

MARRION WILCOX,
Authority on Latin-America.

South-American Literature. See LATIN-AMERICAN LITERATURE.

South Australia. See AUSTRALIA, SOUTH.

South Bend, Ind., city, county-seat of Saint Joseph County; on Saint Joseph's River near the source of the Kankakee River, and on the Lake Shore & M. S., the Indiana, I. & I., the Michigan C., the St. Joseph, S. B. & S., the Terre Haute & I., the Pennsylvania, and the Grand Trunk W. R.R.'s; about 89 miles east of Chicago, 135 miles north of Indianapolis, and six miles south of the Michigan State boundary. It is connected by electric lines with Mishawaka, Elkhart, Goshen, and Niles, Mich., all of which cities and towns contribute to the prosperity of South Bend. The census of 1900 gives the combined population of these places as 33,000. It was settled in 1824 by Alexis Coquillard. It is in the region traversed early by the missionaries and explorers. Across the northern portion of the city was the old portage from the Saint Joseph to the Kankakee. La Salle visited here in 1679, and later years as he journeyed from the «lakes» to the interior. He founded here an Indian village, the Miami tribe; but later the Pottawattomis occupied the place. It is in a fertile agricultural region in which stock raising is given considerable attention.

Industries.— The city is the industrial centre for a large portion of Northern Indiana. Some of the manufactures are plows, wagons, clover hullers, woolen goods, paper, toys, shirts, sewing machine parts, blank-books, bicycles, baking powder, bluing, bank, bar and office furniture, beer, steam boilers, electrical appliances, street sprinklers, wood and paper boxes, brick, cement, brooms, confectionery, cigars, barrels, cultivators, cutlery, dowels, furniture, feed mills, flour, harness, harrows, machinery, ice, knit underwear, lumber, tombstones, mattresses, proprietary medicines, linseed oil, varnish, pulleys, rubber stamps,

Digitized by Google

sash, blinds, doors, screens, seeders, sheet iron products, steel ranges, malleable steel castings, spark arresters, mineral waters, steel skeins, fishing tackle, indurated fibre goods, pharmaceutical goods for physicians, cigar boxes, electrotypes, grain drills, roofing, automobiles, watches, etc. Nearly all the South Bend factories work the entire year.

The Government census of 1909 gives the number of manufacturing establishments 218; the amount of capital invested, $41,467,000; the number of employees in the manufactories, not including members of firms, 13,453; annual wages, $7,497,000; cost of material used annually, $15,253,000; value of products, $27,855,000. The capital invested in the carriage and wagon factories is about $15,000,000, and the value of the annual output, $5,000,000. The output of the agricultural implements works is about $3,000,000; and of the foundry and machine shop products, $2,000,000. There are over 20 wholesale houses.

Buildings and Parks.— The principal public buildings are the Government building, county court-house and county jail ($40,000), city-hall $75,000, Y. M. C. A. building, Saint Joseph's Hospital, Saint Anthony's Convent, the city hospital, and two theatres. The public parks embrace 64 acres. The water supply comes largely from 62 artesian wells; there are about 100 miles of water mains.

Churches and Schools.— There are 32 church buildings and 45 church organizations, representing 15 different denominations. The educational institutions are one public high school, 13 public schools, eight parish schools, Saint Aloysius and Saint Joseph's academies, conservatory of music, commercial schools, teachers' training school, historical society, and a public library. Just outside the limits of the city, in the village of Notre Dame, are the large Roman Catholic schools, the University of Notre Dame (q.v.) for men, and Saint Mary's College, for women.

Banks and Banking.— The four national banks have a combined capital of $500,000; the county savings bank has resources to the amount of $3,500,000; deposits, $3,000,000 and a surplus of $150,000. There are six building and loan associations.

Government and Population.— The government is administered under a special charter granted by the Legislature which provides for a mayor and a council of 10 members. The members of the council hold office for a term of two years. There are about 20 nationalities represented in the city. The various industries and the good wages attract skilled workmen to South Bend. The principal nationalities, other than the English-speaking races, are Germans, Swedes, Poles, Belgians, Hungarians, and Danes. Pop. (1890) 21,819; (1900) 35,999; (1910) 53,684.

FREDERICK A. MILLER,
Editor 'South Bend Tribune.'

South Berwick, bĕr'wĭk, Maine, town, York County; on the Salmon Falls River, and on the Boston & Maine railroad; 40 miles southwest of Portland. Its chief manufacturing interests include shoe factories, cotton and woolen mills, and carriage shops; there is a national bank with a capital of $100,000, and a savings bank. The town has a public library, and is the seat of Berwick Academy, a non-sectarian secondary school chartered in 1791. Pop. (1890) 3,434; (1900) 3,188; (1910) 2,935.

South Bethlehem, bĕth'lē-ĕm, Pa., borough Northampton County; on the Lehigh Valley and the Philadelphia & Reading R.R.'s; about 12 miles west of Easton, the county-seat, and about 40 miles, in direct line, north of Philadelphia. Electric railroads connect it with Allentown, Bethlehem, and other places in the vicinity.

South Bethlehem was settled in 1741; but for many years it increased slowly in population, and its industries were limited to local needs. Since 1850 the number and magnitude of the industries have increased, and the borough has grown in proportion. It is in a manufacturing section, where iron ore deposits and coal fields are convenient, and where there are good transportation facilities. The chief industrial establishments are iron and steel works, machine shops, foundries, zinc and brass works, wood working factories, knitting mills, silk mills, and furniture works. The Government census of 1900 gives the number of manufacturing establishments as 127; the amount of capital invested, $8,713,185; the number of employees, not owners, 5,544; the total wages, $2,390,100; the cost of material used, $5,301,034; the value of the product, $10,964,911. It ranks 19 in the State in the value of its manufactured products.

There are 15 churches, Saint Luke's Hospital, and one home. The educational institutions are the Lehigh University, which has 10 large buildings, Bishopthorpe School, an institution for girls, a public high school, public and parish elementary schools, and public and school libraries. Pop. (1910) 19,973.

South Carolina is in the South Atlantic division of the United States. It lies between lat. 32° 4′ 30″ and 35° 12′ N., and between lon. 1° 30″ and 6° 54′ W. (Wash.). Its area is 33,393 square miles. The State of North Carolina bounds it on the north; the Savannah River, the eighth river in length in North America, on the west; the Atlantic coast on the south and east forms the base of an irregularly shaped triangle with its apex resting on the Appalachian Mountains 200 miles to the north.

Rivers.—Three considerable river systems take their rise in these mountains, and make their way southwardly to the sea. The eastern watershed of the Savannah is narrow, as is also the western watershed of the Pee Dee. The intermediate space occupying the larger portion of upper Carolina is crossed by seven rivers, the Saluda, Tyger, Reedy, Pacolet, Broad, Catawba, Wateree, with their numerous affluents uniting to form the Santee River. A line across the State from Augusta, Georgia, to Columbia, and thence to Cheraw in the east, is known as the «fall line.» On crossing this line the streams pass from the crystalline rocks, the granites and slates of upper Carolina, into the softer strata of the tertiary marls of the low country. Above the «fall line» the average slope of the streams is five feet to the mile, and they are available for the development of water powers to an extent estimated at one million horse-power. Below the fall eight other rivers, the North and the South Edisto, the Combahee, the Coosawhatchie, Black River, Cooper, Ashley, Waccamaw, are found with a fall of 1 to 1½ feet to

Digitized by Google

the mile. The numerous creeks, however, that feed these rivers rising themselves in the elevations of the Sand Hills and Red Hills, have a much more rapid fall. Horse Creek, for instance, emptying into the Savannah below Augusta, furnishes in the length of 10 miles power for the Vaucluse, Graniteville, Langley, Aiken and Clearwater factories, without being fully utilized. The rivers are navigable to the "fall line" for steamboats of 1 to 200 tons and in all there is from 700 to 800 miles of navigation above tide water.

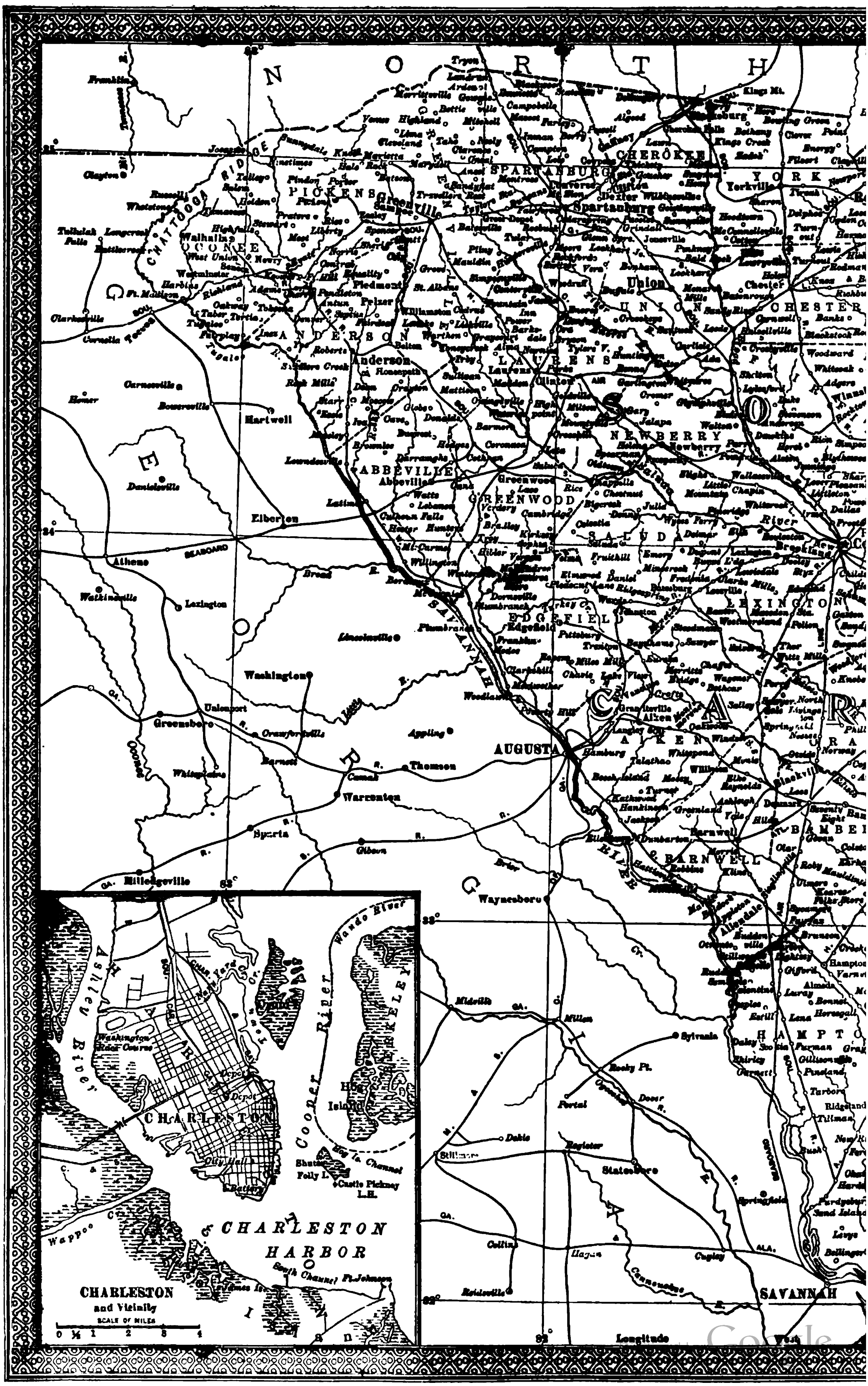
Coast Region.—The coast region has an area of 1,700 square miles, of which ten per cent has been under tillage. The average elevation above sea-level is 10 to 15 feet, rarely 25 to 30. South of the Santee River the mainland is bordered by numerous islands, formed from the detritus brought down by the rivers and banked up south of their outlets by the currents and waves of the sea. They are fringed between high and low tide, by salt marshes and extensive beds of oysters peculiar to this latitude. The mean rise of the tide in the Savannah River is 6.9 feet, and diminishes eastward to 3.5 feet at the Georgetown entrance. The tides push the fresh water of the streams before them on the flood, 15 to 30 miles inland, and render tide-water irrigation of the rice fields practicable. The salt water rivers separating the islands from each other and from the mainland furnish navigable waters for a length of 400 to 500 miles for steamboats and might, with little work, be converted into a continuous inside passage from one boundary of the State to the other. Mills estimated that two or three short canals aggregating eight miles in length, through land barely above tide level, would effect this, and it has been proposed to continue such work beyond Savannah and across Florida to the Gulf, shortening the trip to Panama and safe-guarding the entrance to the American Mediterranean in case of war. It was stated in 1703 that Port Royal Harbor had only 18 feet of water at low tide, and that of Charleston 13 feet; now that of Charleston has 28 to 32 feet and Port Royal 28 to 30. This would seem to be more than should arise merely from the engineering work done, and may in part be due to a subsidence thought to be taking place along the Southern coast. The palmetto and the live oak characterize the growth of the region. It produces oranges of superior quality, and figs in great abundance. It holds a monopoly in the production of the finest variety of long staple silk cotton. Carolina rice, the principal rice crop of America, is grown here. The facilities for transportation and the subtropical climate make the region a favorite one for truck-gardeners. Formerly wealthy planters resided here in great opulence and comfort, but the region has been devastated in every war: by the Spaniards, the Indians, the pirates, by the British in the Revolution; and even in the War of 1812 the English burned the rice mills here. From all these disasters it in time recovered, but it has not yet recovered from its occupation by the armies during the Civil War. That occupation, however, greatly modified opinion as to the unhealthfulness of the climate, for it was found that the troops sustained fair health while quartered here in summer. The mean annual temperature is 63° to 65° F.; summer mean, 74° to 79°; winter 54° to 56°; rainfall 50 to 80 inches. Flowing artesian wells are obtained at various depths; at Bluffton at less than 100 feet, at Coosaw 500 feet, at Charleston 1,960 feet. The formation belongs to the post-Pliocene and rests on the Ashley and Cooper Pliocene marls which furnish the phosphate rock. The rural population does not exceed 10 to 15 to the square mile, and negroes form 80 per cent of it.

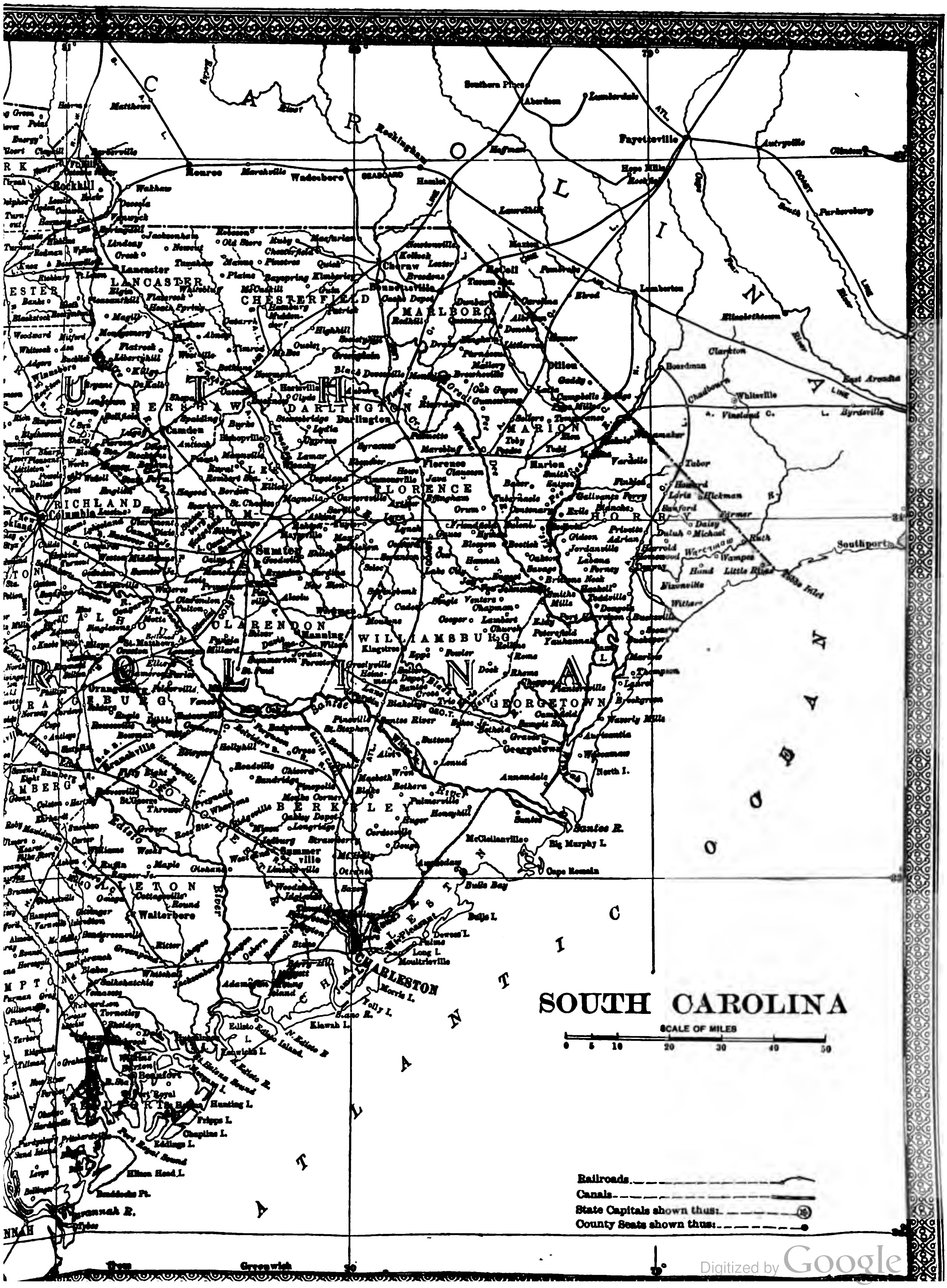
The Lower Pine Belt.—Immediately north of the coast region the Lower Pine Belt, with a width varying from 20 to 70 miles, crosses the State from east to west, covering an area of 10,226 miles. These low level lands bear a strong resemblance to those of the coast. The uplands, the so-called "pine barrens," represent the sea islands, the numerous large fresh-water rivers replace the salt rivers and arms of the sea, and the swamps, covering over 2,000 square miles, recall the salt marshes. Eight large rivers conveying all the rainfall of South Carolina, with a considerable portion of that from North Carolina and Georgia, together with several smaller rivers and innumerable lesser streams, traverse the region. The maximum elevation, 134 feet, is reached at Branchville, on the South Carolina railroad, making the fall to tide water in a direct line 2.8 feet per mile. In the extreme west the fall is greater, 5.8 feet a mile; in the Pee Dee section it is less than a foot to the mile. With proper engineering the fall is sufficient to drain the swamps and bring into cultivation what are perhaps the most fertile lands in the State. Only about 13 per cent is now in cultivation. The remainder is in turpentine farms, or in process of deforestation for yellow pine and cypress lumber. Outcrops of the cretaceous rocks are noted in the extreme southeastern corner of the State, and have been traced northward to Mars Bluff and Darlington C. H., where it passes under the Buhrstone of the Eocene. Superimposed on these cretaceous marls are the Santee marls. They belong to the Eocene and are composed of corals and gigantic oyster shells. Just above tide-water they pass under the Ashley and Cooper marls, composed of many-chambered shells (Foraminifera), sometimes of so fine and compact a structure as to fit them for building purposes. Fragments broken from these marls, and rounded by wave action, form the phosphate rock of commerce. These nodules contain 55 to 61 per cent of phosphate of lime and have been quarried at the depth of one to six feet; they are also found on the bottom of the rivers, and on sea bottoms extending from North Carolina to Florida. The remains of the mastodon, elephant, tapir, horse, cow and hog are found mingled with them, though the Europeans met none of these animals on their arrival, nor were any of the Indians acquainted with them. These marls afford excellent structural limes, and material for the manufacture of artificial cement. Green sands containing 4 to 6 per cent of potash in the form of glauconite also occur here.

The Upper Pine Belt.—The Upper Pine Belt, or central cotton region, lies north of the Lower Pine Belt and south of the Sand and Red Hill region. It covers 6,230 square miles, and 30 per cent of it has been brought under cultivation. The population is 44 to the square mile. The elevation, 130 to 269 feet. A sandy loam overlays the Santee (Eocene) marls. In the northern

Digitized by Google

Digitized by Google


N O R T H
Franklin
Clayton
CHATTOOGA RIDGE
OCONEE
PICKENS
Walhalla
Greenville
SPARTANBURG
Spartanburg
CHEROKEE
YORK
Yorkville
UNION
Union
CHESTER
Chester
ANDERSON
Anderson
LAURENS
Laurens
Clinton
NEWBERRY
Newberry
ABBEVILLE
Abbeville
GREENWOOD
Greenwood
SALUDA
LEXINGTON
EDGEFIELD
Edgefield
AIKEN
Aiken
BARNWELL
Barnwell
Hartwell
Elberton
Athens
Lexington
Washington
Greensboro
Crawfordville
Warrenton
Thomson
Sparta
Milledgeville
AUGUSTA
Hamburg
SAVANNAH RIVER
Waynesboro
Millen
Sylvania
Statesboro
SAVANNAH
Longitude
CHARLESTON
and Vicinity
SCALE OF MILES
0 ½ 1 2 3 4
CHARLESTON HARBOR
Ashley River
Cooper River
Wando River
Hog Island
Shutes Folly I.
Castle Pinckney L.H.
Ft. Johnson
Battery
Wappoo



Digitized by Google

Digitized by Google

portion these marls have been petrified and converted into Buhrstone. In the east there are outcrops of the cretaceous, and occasional islands of miocene marls. The long-leaf pine and varieties of oak, especially the water oak, sometimes shading the fourth of an acre with its foliage, give character to the growth. There are extensive bodies of very fertile swamps on the rivers, subject, however, to occasional overflow, and back swamps equally fertile but needing drainage. The largest recorded crop of corn ever grown on one acre was made here by Mr. Drake, of Marlboro County. The yield was 256 bushels of shelled corn.

Sand and Red Hills.—A range of sand hills rises from the gentle slope of the Upper Pine Belt and attains an elevation of 500 to 826 feet. It is interrupted by hills and elevated levels of red clay lands. Its northern boundary is the «fall line» of the rivers. It covers 4,061 square miles; 29 per cent is under cultivation, and the population is about 32 to the square mile. No lime occurs here, the eocene marls have been converted into Buhrstone of excellent quality for mill rocks. The presence of land and marsh shells in these petrifactions indicates that the original formation was littoral. Some of these beds of Buhrstone have a thickness of 40 feet. Beds of lignite occur in Aiken and Chesterfield, resting on clays suitable for crucibles, with other clays adapted for the manufacture of the finer qualities of ornamental tile. Extensive quarries of kaolin clay are worked here; works for the manufacture of porcelain ware from them have been successfully operated, and many thousand tons are annually shipped to the paper manufactories. Fuller's earth is also found. A «cement gravel» has been much exploited for road material, being shipped by rail to distant points for that use. Roads covered a few inches with it become hard and withstand the weather and much travel The long slopes of these hills face south, and the short slopes north. The latter are the most fertile. The climate is dry owing to the porous sands, but it enjoys an abundant rainfall and is well watered. Besides rivers, the large clear swift running creeks, not counting smaller streams and branches, aggregate 1,100 miles in length. Their average fall is 15 to 20 feet to the mile.

Piedmont Region.— Above the «fall line» the rocks of the Piedmont country occur in the following order of superposition. On granite rests the gneiss, above them occur islands of greater or less extent of mica talc and clay slates, itacolumite and limestones, left from the denudation to which the region has been subjected for untold ages. The average elevation is 700 feet, rising from 545 at Winnsboro to 989 feet at Greenville. It covers 10,245 square miles, of which 35 per cent is under cultivation.

The population is 54 to the square mile. Inexhaustible quantities of building granite of fine quality occur in Fairfield, Newberry, Kershaw, and other counties. Mica slate is found in Abbeyville and Anderson. The peculiar soils known as the «flatwoods» of Abbeyville, and the «meadow lands» of Union, and also the «black jack flats» of Chester and York, are due to the weathering of extensive trap dykes in those localities. Lieber writes in 1859, «above this line (the 'fall line') most streams have some gold in their sands.» Thirty-one gold mines have been opened in the talc slates of Chesterfield, Lancaster, Abbeyville, and Edgefield counties. The Dorn Mine (now McCormick), in the last named county, having yielded $1,100,000. There are 19 gold mines in the mica slates of Spartanburg, Union and York counties. Eight other chiefly gravel deposits, in Greenville and Pickens counties. Argentiferous galena and copper are found in these mines, bismuth in quantity at Brewer Mine in Chesterfield County; iron in magnetic and specular ores in large quantity at Kings Mountain and elsewhere in Spartanburg and Union counties; limestone in York, Pickens, Spartanburg and Laurens; in the latter county there are quarries of marble; feldspar in Pickens, Abbeyville, Anderson and Laurens; barytes on the Air Line railroad in York; manganese in abundance and purity at the Dorn mine, and in Abbeyville, York and Pickens; asbestos in Spartanburg, Laurens, York, Anderson and Pickens; spinel rubies in Pickens; tourmaline in York, Edgefield and Laurens; beryl in Edgefield and Laurens; corundum in Laurens; zircons in Abbeyville and Anderson; one diamond has been taken from the itacolumite in Spartanburg. Recently tin ore in workable quantities has been found, and shipment of it has been made to England to be tested as to its value.

Alpine Region.—The Alpine Region occupies the extreme northwestern corner of Carolina. It has an average elevation of 1,000 to 1,500 feet; Kings Mountain is 1,692 feet; Paris Mountain, 2,054 feet; Cæsar's Head, 3,118 feet; and Mount Pinnacle, 3,426 feet. The mountains here often rise suddenly to their greatest height. The southeastern front of Kings Mountain is 500 feet in perpendicular height, Table Rock is 800 feet vertically above its southeastern terrace. The northwestern slopes descend gradually toward the Blue Ridge Mountains. There would seem to have been in ages past some great fault or land slip here, producing the long southeastern incline running down to the sea, and continuing under its waters for 100 miles to the Gulf Stream, where the 100-fathom depth suddenly sinks to 1,500 fathoms. The region covers 1,281 square miles, of which 18 per cent is under cultivation. The population is about 37 to the square mile. The rocks and minerals correspond with those of the Piedmont, its distinguishing feature is its climate. The mean of the hottest week in 1872 taken at 4.35 P.M. was 90° F. The mean of the coldest week taken at 7.35 A.M. was 25° F. Judged by the temperature of the spring waters taken in June, the mean annual temperature should be 55° to 58° F. The rainfall is heavy, dewless nights are rare, and vegetation luxuriant in consequence. Storms are of rare occurrence. Ramsey says: «There are no marks of trees blown down or struck with lightning, giving rise to the saying 'to pick one's teeth with a splinter from a tree struck by lightning will cure the toothache,' meaning such a splinter is not to be found.» It has long been a summer health resort for the people of the low country.

History.— The first settlement on the continent of North America took place 27 May 1562 on the southeastern extremity of Paris Island in Port Royal harbor. A colony of French Huguenots landed there, and built a fort, naming it, in

Digitized by Google

honor of their king, Charles IX., Carolina (aboriginal name, Chicora). Their ships having returned to France for reinforcements, a fire broke out, which destroyed their barracks and magazine. In this plight they constructed boats, with the assistance of the Indians, and went back to France. In 1665–9 Charles II., of England, claiming Carolina by reason of the discovery of North America by John Cabot, in 1497, when sailing under a patent from Henry VII., granted all that "tract of ground" in America between the 36th degree and 31st degree north latitude, and to the west as far as the South Seas (Pacific Ocean), to eight English noblemen as Lords Proprietors. The grant covered about 1,020,000 square miles or more than one third the area of the present United States, a region since largely peopled from the South Carolina of to-day. The first colony sent out landed in 1670, as the French had, at Port Royal, but removed shortly after to the confluence of the Ashley and Cooper rivers, where they founded the city of Charleston. The Proprietary Government was conducted under a royal charter and certain "Fundamental Constitutions" drawn for that purpose by the famous metaphysician, John Locke. In order to avoid "erecting a too numerous democracy" Locke designed a territorial aristocracy of landgraves, caciques and barons. The colonists, however, insisting upon the clause of the king's charter directing the Lords Proprietors to "govern according to their best discretion by and with the advice, assent, and approbation of the Freemen of said territory, or their deputies or delegates," prevented from first to last this aristocracy from taking root in the colony. The Proprietary Government without adaptability to the circumstances and necessities of the colony, promoted endless discussions and dissensions as to the interpretation of the charter and the "Constitutions." A succession of "heats and broils" during 49 years culminated in 1719. The Proprietors expressed their inability to aid the colonists, refused petitions addressed to them on important matters, and repealed acts of the Assembly laying taxes for the discharge of the public debt, and for the freedom of elections. The Assembly thereupon voted itself a convention, and unintimidated by the threat of the Proprietary Governor to bombard Charlestown from a British war vessel, elected James Moore, governor in the name of the king, and the Royal Government of the Province supplanted that of the Proprietors.

Bancroft and Dana place the highest estimate of the aborigines south of the Great Lakes and east of the Mississippi River at 180,000, or one person to 4½ square miles, a territory now supporting a population of 67 to the square mile, or 301 for one Indian. John Lawson 1703 and Governor Glen in 1743 agree in estimating the Indian population of Carolina at about 1 to 8 square miles. They were generally friendly to the colonists except when incited to sudden outbursts of hostility by the Spaniards, the French, or the British, and formed a more or less important contingent in war, as when James Moore in 1702–3 invaded the Appalachian region with 25 whites and 1,000 Indians and returned with 1,300 captives, who were sold into slavery to the northern colonies and the West Indies.

Negro slaves were introduced from the Barbados in 1671, and were counted to be 12,000 in number at the close of the Proprietary rule in 1720. They were instructed in the Christian religion, and some of them taught to read. It was required of each white militia man that he should train and arm a negro to accompany him in war. The white population had increased from 391 in 1671 to 9,000 in 1720, living chiefly in proximity to Charlestown. While the Indians lived principally on game and fish, cultivating only two plants, corn and tobacco, both exotics, the white colony never suffered for subsistence. They got 30 to 80 bushels of corn from an acre, deer supplying meat; an Indian hunter would for $25 a year furnish a family with 100 to 200 deer, besides wild turkey, fish, etc. The culture of rise was introduced in 1693, and the export of this cereal in 1720 amounted in value to £3,350 sterling. The Proprietors refused in 1674 to send out cattle to the colonists, saying they wanted them to be "planters and not graziers," but seven years later they had so increased that many planters had 700 to 800 head. The Assembly had to appoint commissioners to dispose of unmarked animals, and passed a law for the enclosure of crops, which remained in force until 1882.

As early as 1700 Charlestown had a large and lucrative trade with the Indians in furs and hides, extending 1,000 miles into the interior, and a large export trade in forest products, timber, pitch, turpentine, and provisions to the northern colonies, and the West Indies. Religious freedom was secured, while the ministers of the Church of England were supported from the public funds. The various church members stood as follows: Episcopalians, 42 per cent; Presbyterians and Huguenots, 45 per cent; Baptists, 10 per cent; Quakers, 3 per cent. A free public library was established in Charlestown in 1700, and a free school in 1710. In 1712 a digest of the English and colonial laws was prepared by Chief Justice Trott. In 1717 a successful war was waged against the pirates infesting Cape Feare, and a number of them captured and executed. A duty of £30 a head was laid on the importation of negroes.

George I. and George II. were nursing fathers to Carolina. The Assembly was convened, all actions at law on account of the change of government were declared void, and the judicial proceedings under the provisional administration confirmed. Treaties were made with the Indians, who had hitherto stood as independent neighbors and were now constituted allies or subjects. Parishes were laid out, and whenever settled by 100 families, they were allowed representation in the Assembly. To relieve the burden on the country people of repairing for the trial of all causes to the General Court at Charlestown, county and precinct courts were established. Schools were established in each precinct and £25 levied by the justices to assist in the yearly support of the teachers, who were required to teach 10 poor children free of charge. Between 1733 and 1774, over 200 tutors, schoolmasters, or schoolmistresses, were engaged in the province. The king having bought out the Proprietors for £17,500 purchased also the quitrents due them by the colonists, and remitted them. Charlestown was the extreme southwestern outpost of the British in America. As late as 1741, when the Spanish possessions lay embos-

Digitized by Google

1. The Capitol Building at Columbia.
2. The First Baptist Church Columbia, where the Ordinance of Secession was passed.

Digitized by Google

omed on the Gulf of Mexico, with Saint Augustine, the oldest fortified place in America, the French claimed all the territory lying west of a line starting from a point north of Charlestown, reaching the Appalachian Mountains, running round the headwaters of the Potomac, across the Mohawk and Hudson, down Lake Champlain, and by the Sorrel River to the Saint Lawrence. With little aid from the mother country, the colonists had stood the advance guard against the warring Europeans and held them, the American savages, the African savages imposed upon them, and the pirates in check. The first settlers had confined themselves to the neighborhood of Charlestown. Now the settlement of Georgia, 1732-4, protected the western frontier, and the interior of Carolina, received many immigrants, Germans, and after Culloden many Scotch came into the middle sections, and, on Braddock's defeat, refugees from Virginia and Pennsylvania followed in the Piedmont region. Land was granted free of charge for 10 years, and after that the annual rental was 4 shillings sterling for 100 acres. Great Britain imposed restrictions on the commerce and domestic manufactures of her colonies. While this was prejudicial to the more northern colonies, it did not affect an agricultural people like the Carolinians. The restraints imposed by the navigation acts on colonial exports was removed on the export of Carolina rice. The exports of rice and indigo reached £108,750 in 1847. In 1775 the exports of these two commodities alone were valued at £1,000,000 sterling, a third of what the entire trade of the American colonies was estimated at in 1768. Between 1725 and 1775 the population increased sevenfold. In 1773 Josiah Quincy, writing from Charlestown, says of the city: "In grandeur, splendor of buildings, equipages, commerce, number of shipping, and, indeed, in almost everything, it far surpasses all I ever saw or expected to see in America." With the most sincere and loyal attachment to Great Britain, the king, and his government, the Carolinians sent their children to England and Scotland to be educated and spoke of the mother country as "home."

In the midst of this prosperity Carolina was led, step by step, during a period of 11 years, through sympathy with the northern colonies for injuries inflicted on them, to take part against the enforcement by Great Britain, of taxation without representation without desiring or anticipating the separation from that country, which finally took place. On 28 June 1776, while the congress of the colonies were discussing the Declaration of Independence, Col. Moultrie, from the Palmetto Fort on Sullivan's Island, repulsed with heavy loss the English fleet, and turned back the expedition of Sir Henry Clinton for the invasion and subjugation of the South. In the same year Carolina was the first colony to frame and adopt an independent constitution, but with the proviso that this constitution is but temporary "until an accommodation of the unhappy differences between Great Britain can be obtained."

In 1778, John Rutledge, governor of the State, declared "such an accommodation, an event as desirable now as it ever was." The material injuries to Carolina by the Stamp Act, the duty on tea, and the other acts of the government of George III., were slight as compared with the advantages she enjoyed under English rule, but she had enlisted in no lukewarm manner in the struggle on account of the principles of right and justice involved. It was not until after the fall of Charleston in 1780, when the State lay prostrate, that the outrages of the British armies roused to resistance the population from the seaboard to the mountains. They then flocked to the standards of the partisan leaders, Marion, Sumter, Pickens, and others, and so harassed and delayed the northward movement of Cornwallis to join Clinton, that Washington and Lafayette were enabled to unite in Virginia and force the British into Yorktown. There, blockaded by the French fleet under DeGrasse, they were compelled to surrender and the war virtually terminated in favor of the Americans. Carolina contributed $1,205,978 above her quota to this war — only a few thousands less than Massachusetts, whose war the Revolution was, and who never suffered from invasion — and more than all the other 11 colonies together. One hundred and thirty-seven engagements with the British took place within her borders. In 103 Carolinians alone fought, in 20 others she had assistance, and 14, including Camden, were fought by troops from other colonies. "*Left mainly to her own resources,*" says Bancroft, "*it was through the depths of wretchedness that her sons were to bring her back to her place in the republic after suffering more, daring more, and achieving more than the men of any other State.*"

The eight years of war were followed by eight years of distress and disorganization. The country had been laid waste, churches burned, and industries paralyzed. It was estimated that the British had kidnapped 25,000 slaves, and sold them. They plundered the planters' homes. Bancroft says they pillaged of plate alone to the value of £300,000. After the fall of Charleston there arose a 14-years' dispute between the army and navy engaged in the siege as to their respective shares of the plunder. On 9 Aug. 1787, Carolina ceded to the United States her lands (10,000 square miles), not lying within her present boundaries. On 17 September of the same year she ratified the Constitution of the United States. In 1790 the seat of government was removed from Charleston to Columbia, in the centre of the State, and another Constitution substituted for that of 1776. An amendment in 1808 fixed the number of representatives at 124, allowing one representative for each 62d part of the white inhabitants and one for each 62d part of the taxes raised by the legislature. The Senate to be composed of one member from each election district, except Charleston, which was allowed two. This accentuated the differences already existing between the peoples of the lower and the upper country. The former being the outgrowth of the city life of Charleston, and the first settlers, preponderated in wealth. The other, arising from numerous and separate centres of rural settlement, had the larger and more rapidly increasing number of white inhabitants.

The first tariff act of 1789 imposed an ad valorem duty of 5 per cent on imports (with a few specific duties of 15 per cent) for the support of the Federal government. This was in addition to the taxes raised by each State for its own purposes. It was much higher taxation

Digitized by Google

than under the colonial government, which required in ordinary times only a duty 3 per cent on imports, with an export duty of 3*d.* on hides. Four years later the tariff was raised to 10 and 20 per cent. Ten years after, duties were increased 2½ per cent in aid of the Mediterranean Fund against the Barbary Powers. Double war duties, amounting to 25 to 40 per cent, were imposed in 1812. In 1816 a tariff protecting the industries, that had been found necessary but deficient during the late war, fixed duties at 25 per cent, to be reduced to 20 per cent in 1820. The Carolina representatives supported this not unreasonable protection. The reduction never took place, and at this the Carolina representatives protested. Disregarding their protest, a tariff imposing 12 to 50 per cent duties was passed in 1824. Again, in 1828, without regard to the complaints of the Carolina farmers, who were being forced to contribute to the manufacturing profits of other States, a tariff raising duties 25 to 50 per cent was enacted. Wearied with unavailing remonstrance, a convention of the people of Carolina was called in 1832, which declared the protective tariff law unconstitutional, null and void. To meet this action of the State, Congress passed the Force Bill in 1833 for the collection of customs. In the same month of the same year Congress passed "the Clay Compromise Act" for a gradual reduction of duties until 1842, when they should reach a 20 per cent level. This restored tranquillity, although for the second time the promised reduction was never fully realized.

Coincident with the tariff, another and more serious source of disturbance arose. In 1775 slavery extended over North America from Canada to Florida, inclusive. It had been introduced by Queen Elizabeth, and James II. belonged to the Royal African Company for trading in negro slaves. Now it began to be looked upon with horror, as something strange and foreign to human instincts. The New England Anti-Slavery Society was formed in 1832. In less than four years, more than 100,000 persons had joined Anti-Slavery societies in the Northern and Western States. They demanded of Congress that "all slaves should be instantly set free without compensation of the owners." They declared "we will give the Union for the abolition of slavery." The lesson was taught far and wide that the slave-holders of the South, "a few arrogant domineering self-constituted Aristocracy" were — through the representation allowed them "in proportion to the number of their slaves"— ruling the work-people of the North and denying their industries the protection due from the Federal Government. They declared that "the country must become all free or all slave." The non-slaveholding whites of the South were as violently opposed to the emancipation of the negroes as their brethren of the North were in favor of it. To them it meant Industrial, Political and Social Equality with a people in their midst whom they deemed inferior to themselves. They did not ask for aid to their industries through Federal taxation and did not see why Northern manufacturers should. After years of angry discussion along these lines the crisis came — during a period of unprecedented prosperity in Carolina — on the election by the Anti-Slavery party of a President, in 1860, by less than a third of the popular vote. It found the peoples North and South solidly arrayed against each other with fatal unanimity. The "*irrepressible conflict*" burst into war. The North took the offensive for Federal domination and patronage and for race equality, freedom, and fraternity. They were sustained by the popular sentiment of the European masses. South Carolina and the South rose to a man — with no sympathy or support from without — in defense of State autonomy and white supremacy. From an arms-bearing population of 55,046 in Carolina 44,000 volunteered (most of them not identified with the slave-holding class) in defense of the domestic institutions of the State, its sovereignty and free trade. Ultimately 71,088 were mustered in.

Poorly armed, poorly clad, poorly fed, practically without pay, for more than four years they maintained their cause, losing in battle and by disease 15,638 of their number. The negroes, who, in earlier days, had been enticed away by promises from the Spaniards, and had sometimes sided with the Tories and the British, remained as a rule loyal to their masters in this war, served their families and tilled their fields while they were absent. The issue was decided by force of arms and numbers and was never submitted to legal adjudication. No indictments for treason, as is usual in rebellions, were made. An export duty was placed on cotton and import duties were increased by the National Government. For 12 years negro supremacy was enforced in the State by the Federal Army. When on 10 April 1877, the Federal guard filed out of the south door of the Capitol at Columbia the negro government collapsed without a struggle. The white citizens quietly resumed the administration of affairs. President Eliot of Harvard, in a speech before the Central Labor Union in Boston February 1904, on the world-wide conflict of Labor and Capital, sums up the result of this titanic struggle in these words: "How many things my generation thought were decided at Appomattox; but during the subsequent 40 years it has gradually appeared that hardly anything was settled there except the preservation of the unity of the National territory." For more than two centuries, under 10 written constitutions, the State had been governed by a more than usually centralized democracy. Opposing a similar centralization of functions by the Federal Union, the collision dispersed these functions into smaller and smaller civil divisions; counties, townships, school districts. The latter restricted to an area of 9 to 40 square miles, were endowed with the sovereign power to lay taxes and incur debt. A centrifugal tendency marked, also, in subdivision of farms, and in the establishment of cross-road stores and village banks.

Population.— After the Revolutionary War the population of South Carolina was estimated at 104,000 for representation in the Federal Congress. In 1790 the State ranked seventh; it rose to sixth in 1800–10–20. The decline in rank commencing at the latter date has been continuous, and in 1900 the State ranked 24th. In 1790 the density per square mile was 8.3; in 1900 it was 44.4. The foreign-born population was only .4 per cent of the whole in 1900; at that date the State had lost to other States 233,390 persons born in its limits, and had received from all the others 55,216, making a net loss from interstate migration, of 178,076. The population in 1900 was 1,340,316. In 1910 it was 1,515,400,

Digitized by Google

1. The Calhoun Monument, Charleston.

2. The Custom House at Charleston.

Digitized by Google

an increase of 13 per cent. The white increase during the 12th decade was 20.7 per cent, that of the negro race 13.6 per cent, owing to greater migration of the latter. Negroes formed 45 per cent of the population in 1790; reached their maximum, 60 per cent, in 1880; and were 57 per cent in 1900. The town population was 8 per cent in 1790, being above the average for the whole country, which was 3.3 per cent at that date. In 1900 the towns numbered 19.5 per cent, the population making a gain of 4 per cent during the 12th decade, being, however, far less than the country at large, which stood at 47.1 per cent. The number of towns was 202 in 1900, against 124 in 1890; this does not include a number of unincorporated manufacturing villages of considerable size. Charleston ranked 4th among the cities of the United States in 1790; was 7th in 1840, and now stands 68th. The population under 10 years of age was then greater than in any State except Mississippi and Indian Territory. Of the voting age 44 per

ment favored the exportation of rice, and it became a most profitable crop. When cotton was introduced in the 18th century, as it grew on healthy uplands, and did not require much capital, it was expected that the small white farmer would undertake its culture. The small farmers, however, did not, except as overseers, take to cotton planting until after the emancipation of the slaves. Owing to the subdivision of the farms, their number increasing rapidly from 33,171 in 1860 to 176,180 in 1910, the small farmer became much in evidence. Even then little cotton was grown by white labor exclusively. The small farmers of both races modeled themselves after the methods of an agriculture that had been successful for nearly two centuries. They confined their energies largely to one "money crop" for export. They worked at it with hired labor, on borrowed money, purchased instead of breeding work animals, bought a notable portion of their supplies, and largely of fertilizers.

FARM VALUES.

	Per cent increase	Per cent decrease	Values per capita of the population engaged in agriculture			
	1850–60	1860–70	1870	1880	1890	1900
Land and buildings	69	60	$216	$230	$302	$322
Implements and machinery	69	60	11	10	12	16
Live stock	59	48	62	51	50	51
Farm products	....	....	202	139	159	170
Fertilizers	....	....	....	....	12	11

PRICE OF COTTON.

1850–60	1860–70	1870–80	1880–90	1890–1900
8c to 16⅛c	10c to $1.90	25⅞c to 9¼c	13½c to 5½c	7 5-16c to 13½c

cent are white and 57 per cent negro; very few of the latter vote, being disqualified by educational requirements. Of the militia age 44 per cent are whites and 56 per cent negroes. The per cent of the population over 10 years of age engaged in gainful and reputable occupations has been as follows:

	1860	1870	1880	1890	1900
All occupations	73	50	58	54	60
Personal and professional	....	14	16	14	15.6
Manufactures	....	5	5	7	10.3
Trade and transportation		3	3	5	5.1
		100	100	100	100

Agriculture.—The settlers in Carolina soon ascertained that its soil and climate were suitable for all the plants of the Old World growing from the subtropical to the sub-Arctic regions, beside a most varied flora of its own. They found also extensive pastures supporting numerous herds of wild buffalo, elk and deer. The horses and cattle introduced by the Spaniards increased rapidly in numbers. It might have been thought that here were elements favorable for a diversified husbandry. The colonists, however, discovered an agricultural monopoly and an export "money crop" in rice. It required capital for drainage and irrigation, and a thoroughly organized and reliable labor able to resist the malarial influences of the rice swamps. Negro slaves fulfilled these conditions. English merchants furnished the negroes and supplies on credit. The English parlia-

The lien law securing the collection of advances made on growing crops, often even before they were planted, and the fence law requiring the enclosure of all live stock, leaving lands under crops unenclosed, promoted existing tendencies in agriculture. Removing the cost of fencing on land under crops led to a wide deforestation and careless cultivation. Per cent of area by tenure is: owners 64 per cent, cash tenants 22 per cent, share tenants 14 per cent. The percentage of value of the crops grown is as follows: cotton 50, grain 15, animal products 13, vegetables 5, hay 3, tobacco 2, rice 2, forest products 1, sundry 9.

Manufactures.—Antedating the establishment of the Patent Office by more than a century, the colonial Assembly in 1691 passed an act "for rewarding ingenious and industrious persons to essay such machines as may conduce to the better propagation of the produce of this State." In 1778, tide water power was for the first time utilized in milling for cleaning rice. The machinery of these mills is the model on which this industry (performed before by hand) has since been conducted. A cotton factory was established in 1784 at Murray's Ferry, Williamsburg, and one at Statesburg a few years later. The first saw gin — patented by Ogden Holmes and serving as the type of all the short staple cotton gins of the South ever since — was erected in 1795 on Mill Creek, Fairfield County. Mills in the statistics of South Carolina, 1826, states that Mr. Waring operated a small cottonseed-oil mill at Columbia and "expressed from cotton seed a very good oil." In 1903 there are 74 cottonseed-oil mills in the State. The value

Digitized by Google

of the products is $10,330,000. In addition to this the improved gins operated at these mills have greatly cheapened the cost of ginning, which, together with high prices paid for seed, adds 1.22 cents per pound to the value of lint cotton. The oil is a good edible oil, and the by-products, meal and hulls, are the cheapest form of stock food and fertilizer. The leading figures for manufactures are:

1890 Per cent of population of school age enrolled, white 48.4, negro 36.2, of total 40.5, expenditure	$460,260
1903 Per cent of population of school age enrolled, white 52, negro 45.1, of total 51.4, expenditure.............	1,046,054
1890 per cent of population of school age illiterate white 17.9, negro 64.1, of total 45.0.	
1903 Per cent of population of school age illiterate white 13.5, negro 52.8, of total 35.9.	

	1850	1860	1870	1880	1890	1900	1909
Establishments.......	1,430	1,230	1,584	2,078	2,382	7,930	1,854
Capital..............	$6,053,265	$6,936,750	$4,320,235	$29,279,261	$29,279,261	$70,056,299	$173,221,000
Hands................	7,066	6,904	8,140	15,828	24,662	55,117	76,303
Wages................	$1,127,712	$1,380,027	$1,234,972	$2,836,289	$6,590,983	$9,633,651	$24,117,000
Material.............	$2,787,534	$5,198,881	$4,684,109	$9,855,538	$18,873,666	$34,284,482	$66,03,000
Products.............	$7,045,477	$8,615,195	$7,886,103	$16,738,008	$31,926,681	$59,862,110	$113,236,000

The increase in the production of cotton goods in 1890–1900 was 203 per cent, a greater increase than that made in any other State. Owing to its abundant water power, the low cost of living, and the accessibility of material, this increase places the State second in rank in this line of manufactures, Massachusetts alone surpassing it. Out of 146,225 horse-power employed in manufactures, only 35,019 horse-power water has up to this time been employed, leaving a large margin for future use. "The first extensive use of electrically transmitted power in cotton manufacturing in the United States was made at Columbia, where 1,340 horse-power was developed, and the second at Pelzer with 3,000 horse-power."

Education.— The distinguished educator, Dr. J. L. M. Curry, said in 1881: "taking man for man, negroes excluded, the South maintained a larger number of colleges, with more professors and at a greater annual cost than was done by any other section of the Union." The character of those who have taught in Carolina entitles the State to share in this distinction. Here are a few of their names: Dr. Yarden, vice-president of the Royal Society; Thomas Cooper, friend of Burke, Pitt, Fox, Jefferson and Calhoun; Francis Lieber, Membre de l'Institut; Louis Agassiz. It was to the higher education that old Carolina paid chief attention. There were colonial free schools, and free schools were also established by the Legislature in 1811. In 1828 there were 840 of these schools with 9,036 pupils. In 1860 there were 724 schools with 18,915 pupils and an expenditure of $127,529. The reconstruction constitution of 1868 replaced the free schools by a system of public common schools. After a trial of 11 years, the finances were found to be in utter confusion. On the withdrawal of the Federal troops the white citizens restored order. A 2-mill tax, afterward raised to 3 mills, was imposed on all property for the support of the public schools, together with the poll tax, with the following results:

Institutions for higher education are approximately as follows:

WHITES

Colleges		Teachers		Students		Revenue	
		Men	Women	Male	Female	State	Other
State.......	4	80	31	795	456	$187,918	$34,638
Denominational	14	78	66	822	1343	....	144,190
Private...	5	20	28	176	295	......	16,200
	23	178	125	1793	2094	$187,918	$195,028

NEGROES

Colleges		Teacher		Students		Revenue	
		Men	Women	Male	Female	State	Other
State......	1	13	9	360	364	$6,500	$20,707
Denominational	6	41	51	1189	1395	....	71,640
Private....		..	..	....	....	....	....
	7	54	60	1549	1759	$6,500	$92,347

These figures do not include numerous private schools nor sums derived from dispensary profits, nor any extra tax imposed by individual school districts for the support of their schools. There are 205 districts collecting taxes of 1 to 4 mills for this purpose. They show, however, the expenditure by the State of $1,239,272 for the education in whole or in part of 290,688 of her citizens. The cotton mills have invested $86,164 in school houses, and supplement the State school funds with $71,314 annually for the education of the children of the operatives, giving them a school term more than twice as long as that of the public common schools of the State.

Banks and Banking.— The following is a statement of the number of banks established in South Carolina and their capital as far as reported:

	State		National		Saving		Private		Total
	Number	Capital	Number	Capital	Number	Capital	Number	Capital	
1859...	20	$14,962,062	....	....	....	....	....	....	$14,962,062
1869...	....	....	3	$823,500	....	....	....	....	823,500
1881...	4	5,912,248	13	1,185,000	1	$30,000	8	$63,482	2,488,516
1903...	127	510,534	18	2,173,000	15	785,000	16	142,900	9,013,148
1909...	117	....	31	....	22	....	3	....	....

Digitized by Google

The banks share the tendency of the civil divisions, the towns, the farms and the schools to become smaller and more numerous. Seventy-two of those above enumerated were established since 1900.

Bibliography.— Burton, 'Slavery and the Remedy' (1856); Elliott, 'Cotton is King' (1860); Ruffin, 'Agricultural Survey of South Carolina' (1843); State Geological Reports; Simms, 'Geography of South Carolina' (1843); McCready, 'History of South Carolina' (1902); Ransom, 'Resources and Industries of South Carolina' (1888).

HARRY HAMMOND,
Author of 'South Carolina: Resources, Population, and Industries.'

South Carolina College, the State college located at Columbia, S. C., chartered in 1801, and first opened in 1805. In July 1863 the college was closed on account of the Civil War, many students having enlisted in the Confederate army, and the buildings were used as a hospital by the Confederate government. The charter was amended in 1865, departments of medicine and law added, and the name changed to the University of South Carolina; the unsettled political condition of the State led to the closing of the institution a second time in 1877. The next year the charter was again altered, and the University divided into two branches, South Carolina College at Columbia and Claflin College at Orangeburg (the latter for colored students); the branch at Columbia was opened in 1880 as the South Carolina College of Agriculture and Mechanic Arts. In 1882 several new departments were added and "of Agriculture and Mechanic Arts" dropped from the name; the Law School was added in 1884. In 1887 the charter was changed for the third time, the name of University of South Carolina again adopted, and a College of Pharmacy, Graduate Department and Normal School added. In 1890 there was a fourth reorganization, the agricultural, mechanical, medical and normal courses were discontinued, and the name changed to South Carolina College. In 1894 normal courses were added to the curriculum. The college now offers the following courses: (1) Four courses, classical, Latin-science, Latin-literature, and modern literature, leading to the degree of A.B.; (2) two courses, mathematical, physical and chemical-biological, leading to the degree of B.S., also special courses in civil and mechanical engineering by the addition of certain studies to the mathematical physical course; (3) three normal courses, one of four years, leading to the degree of A.B., one of three years and a special course of two years; (4) a two years' course in the Law School, leading to the degree of LL.B., and (5) a graduate course for the degree of A.M. The work of the last two years of the A.B. and B.S. courses is partially elective. The special normal course is strictly professional and includes practice work. There are also normal courses for teachers given in the spring. There are 12 scholarships, besides State scholarships for each county for normal students. The library in 1904 contained 33,783 volumes; the students numbered 225, and the faculty 16.

South Carolina Inter-State and West Indian Exposition, a commercial and industrial exhibition held at Charleston, S. C., from 1 Dec. 1901 to 1 May 1902, at which exhibits were made from nearly all the Southern States and from the West Indian Islands. The exposition showed the remarkable progress made by the South Atlantic States in commerce and industry since the Civil War.

South Company, The, or **Swedish West India Company**, a commercial organization founded in October 1624, by Willem Usselinx, of Antwerp, under a charter granted by Gustavus Adolphus, for special trading privileges with America. The king subscribed 400,000 daler, and stock was taken by other Swedes. Combining later with certain Dutch merchants, the company effected settlements along the Delaware River.

South Dakota, the "Sunshine State," one of the western United States located west of Minnesota and Iowa, north of Nebraska and east of Wyoming. It lies chiefly between the 97th and 104th degrees of longitude and the 43d and 46th degrees of latitude. This gives it an area of 76,620 square miles, or 49,036,800 acres; an empire in itself, being 360 miles wide from east to west and about 225 miles from north to south. It is one and one fourth larger than all the New England States — more than one and one half times the size of New York and as large as both Indiana and Ohio. The word Dakota is of Indian origin and means "leagued or allied."

Geology and Topography.— South Dakota has greater extremes of altitude and greater variety of topography than any other State east of the Rocky Mountains. Big Stone Lake, in the northeastern part, is its lowest point. This is less than 1,000 feet above sea-level (967), while in the southwestern portion of the State, known as the "Black Hills," there are elevations which rise to nearly 8,000 feet. Harney Peak is given at 7,216 by best authorities. These extremes surpass anything to be found in New England or any State east of the Mississippi River. The surface also varies from that of level plains, which may be found in the James or Dakota River Valley and along the Missouri, to high table-lands with gentle undulations, as west of the Missouri and in smaller areas on the summit of the Coteaus. Then there is a region of narrow cañons, hundreds of feet in depth, presenting on a smaller scale the wildness and picturesqueness of the Rocky Mountains, as the Elk Creek and Spearfish cañons in the Black Hills and the rugged, craggy needles of Harney Peak and vicinity. There are areas in the State where you cannot find a stone the size of an egg for a score of square miles and other sections where rocks and stones may be found in great abundance — where erosion went on so rapidly as to produce barren conditions. The Bad Lands of White River are a good illustration of this formation.

The surface may be classified as follows: (1) *The Black Hills.*— There are mountainous elevations — much eroded — dome-shaped peaks pushed up above the horizontal beds that cover the surrounding region. (2) *The Table Lands.* These occupy the region east of the Missouri chiefly and were formerly called by the French "Plateau du Coteau du Missouri." (3) *River Valleys*, including the present flood plains and also higher terraces, such as the Missouri River, which divides

Digitized by Google

the State in nearly two equal parts, the Cheyenne, White, James, and Sioux River valleys. (4) *Bad Lands.* A limited area in southwestern portion of the State, between the White and the Cheyenne rivers. This area has some unique characteristics which demand fuller description. These several divisions require further description to be appreciated.

The Black Hills District has an area of about 5,000 square miles and occupies a prominent position in southwestern corner of the State. Their true limits are distinctly marked by a sharp ridge of sandstone from 300 to 600 feet in height. This ridge is separated from the higher mass of hills by a valley from one to three miles in width, known as Red Valley, so named by the Indians from the brick red soil found there. From this valley one ascends gradually the outer slope of the hills proper and soon enters an altitude of 4,000 to 5,000 feet. This outer slope presents great variety of soil formation. It is underlaid by older sedimentary rocks cut in all directions by narrow and deep cañons. This feature applies to all the southwestern portion of the State. From the broken interior edge of this slope (this sedimentary plateau) one descends a bluff and enters a central area of slates — granite and quartzites formation. These are in many places carved into high ridges and sharp peaks cut by numerous narrow and deep valleys and ravines and with thickly set Rocky Mountain pine timber. Toward the south of this elevated plateau, Harney Peak rises to over 7,000 feet above sea-level and toward the north, Terry and Custer peaks attain quite an altitude and present a rugged and interesting surface.

The Table Lands correspond approximately to the early surface of the State. They slope from an altitude of about 3,500 feet along the western boundary eastward to an altitude of 2,000 feet near the northeast corner and to 1,450 feet near the southeast corner. This makes an average slope eastward of about four feet per mile along the northern boundary and less than six feet along the southern boundary. The highlands are eroded into undulations and traces are present of higher strata which every here and there stand out as buttes and ridges. The region which best illustrates this peculiarity is the northern part of that district lying west of the Missouri River. On the east side of the river these highlands are less prominent and yet may be readily located. The Bijou Hills, Wessington Hills, Ree Hills, etc., are all of this same formation as are the Choteau Creek Hills and Turkey Ridge in the southern portion of the State.

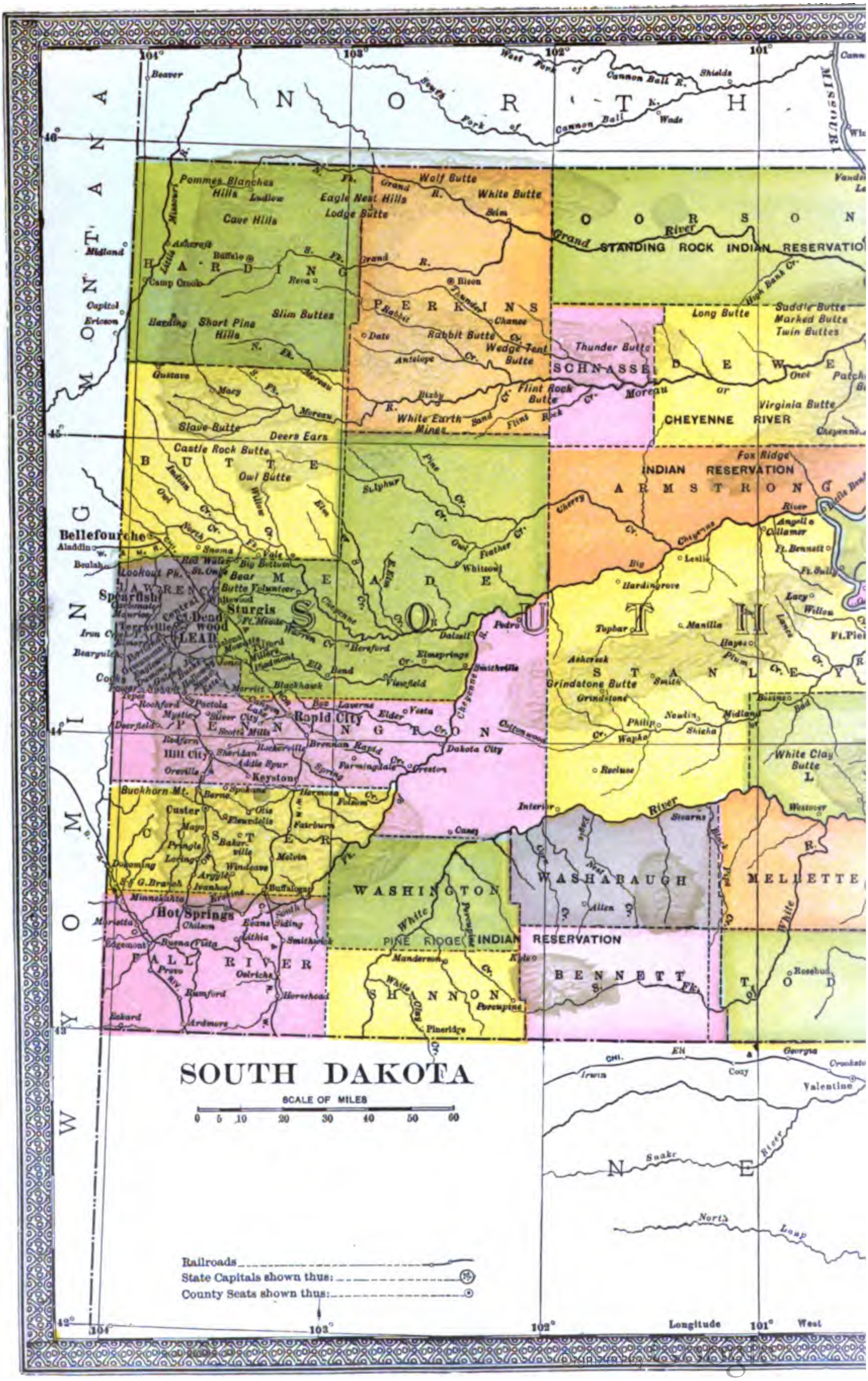
There are three very important valleys crossing the State from north to south. These are the Missouri, the James, and Big Sioux. The Minnesota also touches the northern portion of the State where it has an altitude of about 1,000 feet above the sea. The James River Valley is from 60 to 70 miles wide and from 1,200 feet high about the northern boundary line to 100 feet at the southern line. It has five important branches. One extends west from Aberdeen at an altitude of about 1,500 feet, another west from Huron and the third extends southwest from Scotland, and the fourth southeast from Marion. The fifth is northeast from Aberdeen and connects this James Valley with the Minnesota. All of these valleys have been very much eroded by glacial movements and are less sharply defined than are the valleys west of the Missouri River. The Missouri River Valley is very narrow, usually less than three miles in width in South Dakota. Its western tributaries are also marked by narrow cañon-like valleys. Examples of this are the Grand, the Cheyenne and White River cañons. Along all of these Western rivers may be found a similarity of formation quite unique and presenting many features of interest to the student of nature. On the extreme eastern side of the State, extending nearly the entire length of the same and forming for nearly 100 miles the eastern boundary, is the big Sioux River Valley. This embraces the best agricultural soil in the State and is not surpassed in fertility by any State in the Union.

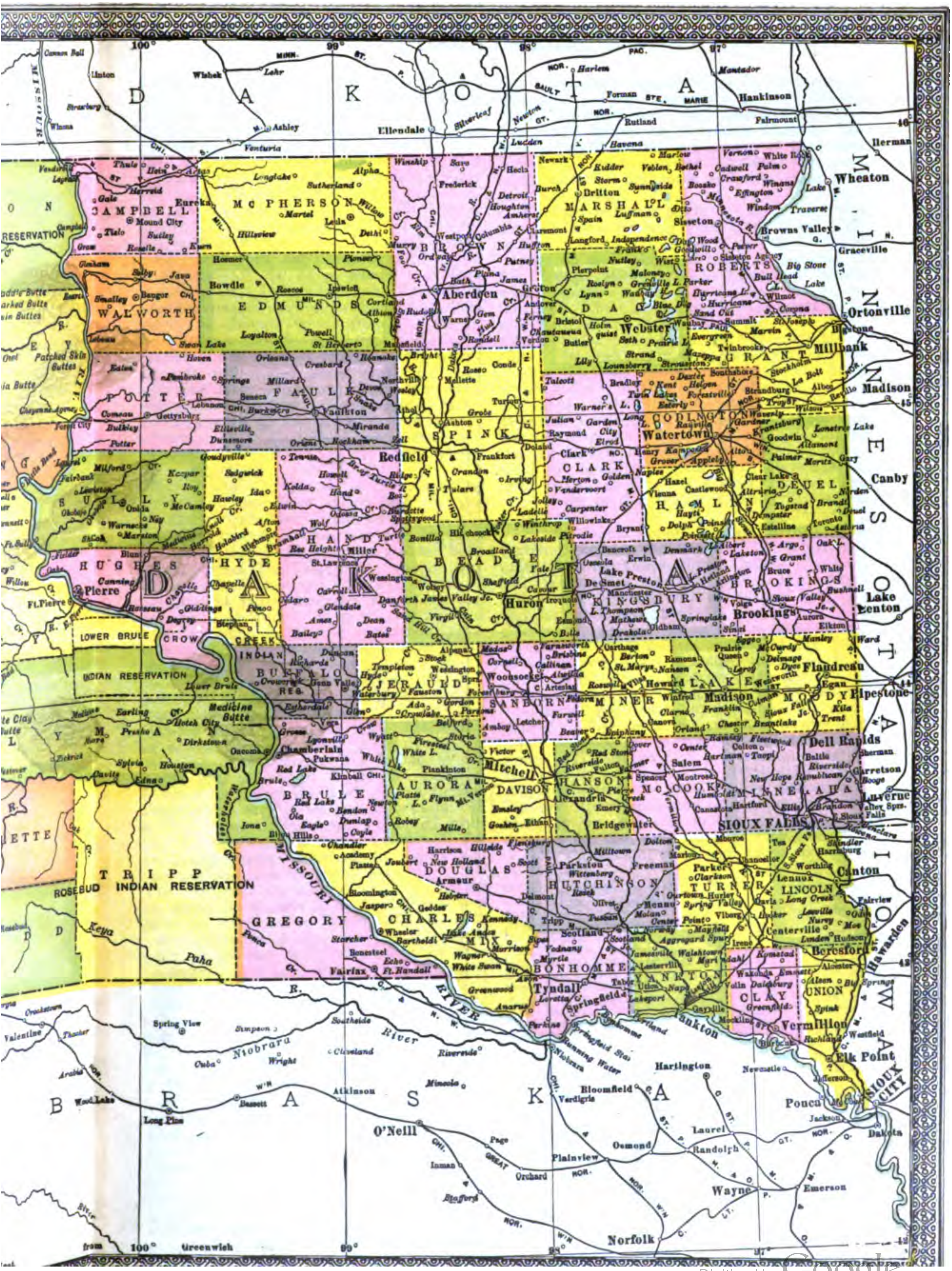
The Bad Lands.— These have become famous. Their features and treasures have attracted early the hunter and the explorer. The term "bad" has been applied to them because of the difficulty of exploring that region. The most notable "bad lands" or "mauvaises terres" in the State are located between the Cheyenne and White rivers. This whole region is cut up by deep ravines, bounded largely with high continuous clay bluffs. Most of the surface is without useful vegetation. The peaks and bluffs seem to have been carved by rapid erosion out of the white clays — marls and sands of the Tertiary Geologic Period. The "Bad Lands" have become widely known, chiefly through the fossil remains they contain. The most fruitful field for this is what is known as Indian Draw, a south branch of the Cheyenne River. Here the stream has eroded a valley five or six miles in width, bounded by steep cliffs over 300 feet high. This valley is dissected into an indescribable labyrinth of buttes, ravines, grassy valleys, and dry water courses. Here the light colored clays of the Tertiary Period rest directly on the dark cretaceous shales. In the lower strata of the Tertiary are to be found the best fossil remains. Many of these have found their way into our best Eastern museums and are evidences of mammoth animals of various types that once inhabited the forests of the State.

Archæological Remains.— The State also contains interesting archæological remains. These indicate the occupancy of a prehistoric race of greater industry and intelligence than the Indians. One of these is the remains of a strong fort near Pierre. It embraces about 130 acres of ground, is admirably located for strategic purposes, is laid out with a skill and accuracy that challenges the admiration of modern military engineers. Within this are found remnants of pottery which give evidence of a high degree of skill and artistic sense. Copper instruments, highly tempered, are also found indicating an art now lost to man. The walls of the fortification are very heavy and well constructed, suggesting an industry and a skill never exhibited by any Indian tribes. There are similar fortifications at several other strategic points in the State, such as Chamberlain, Vermilion, and Campbell County. Near old Fort Wads, in Marshall County, are also extensive mounds which army engineers long ago pronounced must belong to the work of a prehistoric race.

Digitized by Google

Digitized by Google


SOUTH DAKOTA
SCALE OF MILES
0 5 10 20 30 40 50 60
Railroads
State Capitals shown thus:
County Seats shown thus:
NORTH
MONTANA
WYOMING
NE
HARDING
PERKINS
CORSON
STANDING ROCK INDIAN RESERVATION
SCHNASSE
DEWEY
CHEYENNE RIVER INDIAN RESERVATION
ARMSTRONG
BUTTE
MEADE
LAWRENCE
PENNINGTON
STANLEY
CUSTER
FALL RIVER
WASHINGTON
SHANNON
PINE RIDGE INDIAN RESERVATION
WASHABAUGH
BENNETT
MELLETTE
TODD
Bellefourche
Spearfish
Deadwood
LEAD
Sturgis
Rapid City
Hot Springs
Custer
Buffalo
Bison
Pierre
Longitude
West
104°
103°
102°
101°
46°
45°
44°
43°
42°



Digitized by Google

Digitized by Google

Climate and Rainfall.— This State is noted climatically for its abundance of sunshine. From weather bureaus (one year) the following interesting facts appear: Dodge, Kan., has 193 clear days; Denver, Colo., 188; and Huron, S. Dak., 264 fair or clear days; while Buffalo, N. Y., had but 44 such days. No Northern State has fewer cloudy days. The mean yearly temperature is about 44.8 degrees and is higher than either Minnesota or New Hampshire, which have respectively 38 and 26½ degrees. Rainfall averages over 20 inches, but is much more in the eastern section of the State, where it exceeds 30 in some years. The air is dry in winter and a low temperature is endured without much suffering. The chinook winds from the Pacific warm currents modify the temperature very perceptibly. The State is seldom visited in recent years with those bitter northern blasts driving fine flour like snow in the face of a terrific wind. The storms were termed «blizzards» and gave to the State an unfortunate reputation. As a usual thing the winters are not severe. Cattle range for the entire winter on the open prairie.

History and Occupation of People.— The settlement of the State dates back to the year 1831, though Fort Tecumseh was established it is claimed in 1796, and was in ruins 1831. On 18 June of that year a steamboat, built by the American Fur Company, found its way to Fort Pierre. This was the first steamboat to navigate the upper Missouri River and was named the Yellowstone. It greatly accelerated the fur trading industry and commercial relations with the Indians. This same boat made another trip up the Missouri through South Dakota in 1832 and this time went as far north as the mouth of the Yellowstone River. Among its passengers on this trip was George Catlin, the famous painter and ethnologist. Mr. Catlin spent several weeks at Fort Pierre during the summer of 1832, studying the Indian in his primitive life, and again visited the State in 1836 while inspecting the work of the Indians at Pipestone Quarry in western Minnesota. In 1838 Gen. John C. Frémont, the noted pathfinder, explored the eastern portion of the State, taking levels of prominent points and discovering and naming many lakes.

The next year the general again visited the State, going by steamboat to Fort Pierre and from thence northeast to Devils Lake, N. Dak. He was accompanied this time by Joseph N. Nicollet, geographer and astronomer. By 1840 the activity of the fur company had decreased the buffalo herds and fur bearing animals of the Dakota Territory and the fur industry was fast becoming less important in this region. Ten or twelve years more, or by 1855, the fur trade of Dakota was about over, the great buffalo herds of the plains had disappeared. Fort Pierre was sold that year by the American Fur Company to the United States government and thereafter became a military post of great importance.

The first permanent industrial settlement in the State was made at the present site of Sioux Falls in 1856. The next year the Minnesota legislature chartered the Dakota Land Company and from that on settlements were made at various places on the eastern side of the State and along the Missouri River. A territorial government was provided by Congress in 1861 after a long controversy between citizens of the Territory and congressional representatives from Minnesota, the latter claiming Dakota belonged to and was a part of Minnesota Territory. Indian warfare interfered very seriously with the settlement and development of this new land.

Railroad building began in 1872. The Dakota Southern Railway built from Sioux City up the Missouri River as far as Vermilion and in 1873 on to Yankton. This is now a part of the Chicago, Milwaukee and Saint Paul system which operates about 1,500 miles of road in the State. The Chicago and Northwestern Railway entered the State about the same time, 1872, but did not operate its line until about 1879. The company now operates 747 miles of road in the State. Other railroads in the State are as follows: Burlington and Missouri Valley, 270 miles; Chicago, Rock Island and Pacific, 82 miles; Chicago, Milwaukee, Saint Paul and Omaha, 88 miles; Great Northern, 266 miles; and the Minneapolis and Saint Louis, 35 miles. Gold was discovered in the Black Hills district, near Custer, in 1874, by a placer miner. The output now of that region is nearly $10,000,000 a year.

South Dakota became a State in 1889. The enabling act was the Omnibus bill which admitted into the Union North Dakota, Montana, and Washington also. It provided a liberal endowment of lands for educational purposes and for penal and charitable institutions. The chief occupation of the people is farming except in the southeastern portion of the State where mining is the principal industry. It is estimated that there are about 55,000 farmers for all the crops produced in South Dakota. The entire population of the State is (1910) 583,888. This population produces in one year about $150,000,000 of wealth. All but something like $10,000,000 of this comes from the farmers of the State. The total value of all farm property in the State is about $300,000,000. The per capita production of new wealth in the State during 1903 was $263.77, an increase of nearly 5 per cent over the year 1902.

The statistics of wealth produced were then as follows:

Wheat, 45,266,000 bushels	$29,422,900
Corn, 52,320,000 bushels	15,819,200
Oats, 26,000,000 bushels	7,280,000
Barley, 11,132,500 bushels	4,000,000
Rye, 700,000 bushels	290,000
Flax, 3,500,000 bushels	2,800,000
Potatoes, gar. fruit, etc	3,750,000
Hay and fodder	13,840,000
Dairy and creamery	6,590,000
Poultry and eggs	4,521,000
Live stock	35,950,164
Wool and hides	1,800,000
Minerals, stone, and cement	10,000,000
Total for 1903	$136,063,264
Total for 1902	121,124,000
Net gain	$14,939,264

Per capita, new wealth, $263.77.

The assessed valuation of the property of the State in 1910 was $321,070,665, which was 20 per cent of the actual value; on real property, $235,006,539; on personal property, $86,064,126. The tax rate is $4 per $1,000. Private finances are in a flourishing condition. Bank deposits aggregated $31,000,000, of which fully 65 per cent represented the surplus of farmers and ranchmen.

Digitized by Google

Education.— South Dakota surpasses any other State in the Union in her provision for education. Two sections of land in each township are set aside for public school purposes, besides large amounts are donated to the several higher institutions of learning in the State. None of this land can be sold for less than $10 per acre. Some of it has been sold, but the State still owns something like 2,500,000 acres. There is a school fund now on hand of over $4,000,000, drawing interest at 5 and 6 per cent. This is on the increase and will soon be sufficient to defray all the expenses of public education. There is a well established system of public schools in the State, both rural and city, also higher institutions of learning as follows: State University, Vermilion; Agricultural College, Brookings; School of Mines, Rapid City; State Normal Schools, at Madison, Aberdeen, Springfield, and Spearfish. These institutions are all governed by a board of five regents, appointed by the governor, confirmed by the senate and hold office for six years. There are also several denominational colleges in the State. Yankton College at Yankton and Redfield College at Redfield are both under control of the Congregational Church. Huron College at Huron, Presbyterian, and Dakota University at Mitchell are Methodist. The Baptists and Episcopalians control colleges at Sioux Falls and the Norwegian Lutherans a college at Canton and a normal school at Sioux Falls. The Roman Catholics have schools of academic grade at Sioux Falls, Deadwood, and Aberdeen.

Charitable and Penal Institutions.—These are managed by a board of control of five members, appointed by the governor: The Hospital for Insane at Yankton; the Hospital for Feeble Minded at Redfield; the School for the Blind at Gary; the State Penitentiary at Sioux Falls; the Reform School at Plankinton.

Churches.—The people of the State have invested largely in churches as well as schools. The following statistics give some idea of the religious activity and faith of the people:

	Buildings	Members	Property
Roman Catholics	175	30,750	$300,000
Methodist Episcopal	265	13,000	400,000
Norwegian Lutheran	145	10 000	58,500
Congregational	147	6,000	225,600
German Lutheran	100	5,670	50,000
Presbyterian	130	5,750	160,450
Baptist	110	5,860	265,150
Protestant Episcopal	85	3,675	240,510

Population.—There are 61 counties and 2 reservations in the State as follows:

Armstrong
Aurora
Beadle
Bonhomme
Brookings
Brown
Brulé
Buffalo
Butte
Campbell
Charles Mix
Clark
Clay
Codington
Corson
Custer
Davison
Day
Deuel
Dewey
Douglas
Edmunds
Fall River
Faulk
Grant
Gregory
Hamlin
Hand
Hanson
Harding
Hughes
Hutchinson
Hyde
Jerauld
Kingsbury
Lake
Lawrence
Lincoln
Lyman
McCook
McPherson
Marshall
Meade
Miner
Minnehaha
Moody
Pennington
Perkins
Potter
Roberts
Sanborn
Schnasse
Spink
Stanley
Sully
Sterling
Tripp
Turner
Union
Walworth
Yankton

The population of the State: in 1880 was 98,268, in 1890 this had increased to 328,808, and in 1900 to 401,570. At the 1910 census it was 583,888.

The largest cities in the State in 1910 were: Sioux Falls, 14,094; Lead, 8,392; Aberdeen, 10,753; Yankton, 3,787; Mitchell, 6,515; Watertown, 7,010; Pierre, 3,656; Huron, 5,719.

Bibliography.—Foster, 'History of Dakota' (1875); Wixson, 'The Black Hills Gold Mines' (1875); Hagerty, 'Facts about South Dakota'; Armstrong, 'The Early Empire Builders of the Great West'; Chittenden, 'The History of the American Fur Trade of the Far West'; Catlin, 'North American Indians'; Taylor, 'Frontier and Indian Life'; Sharp, 'The Spirit Lake Massacre.'

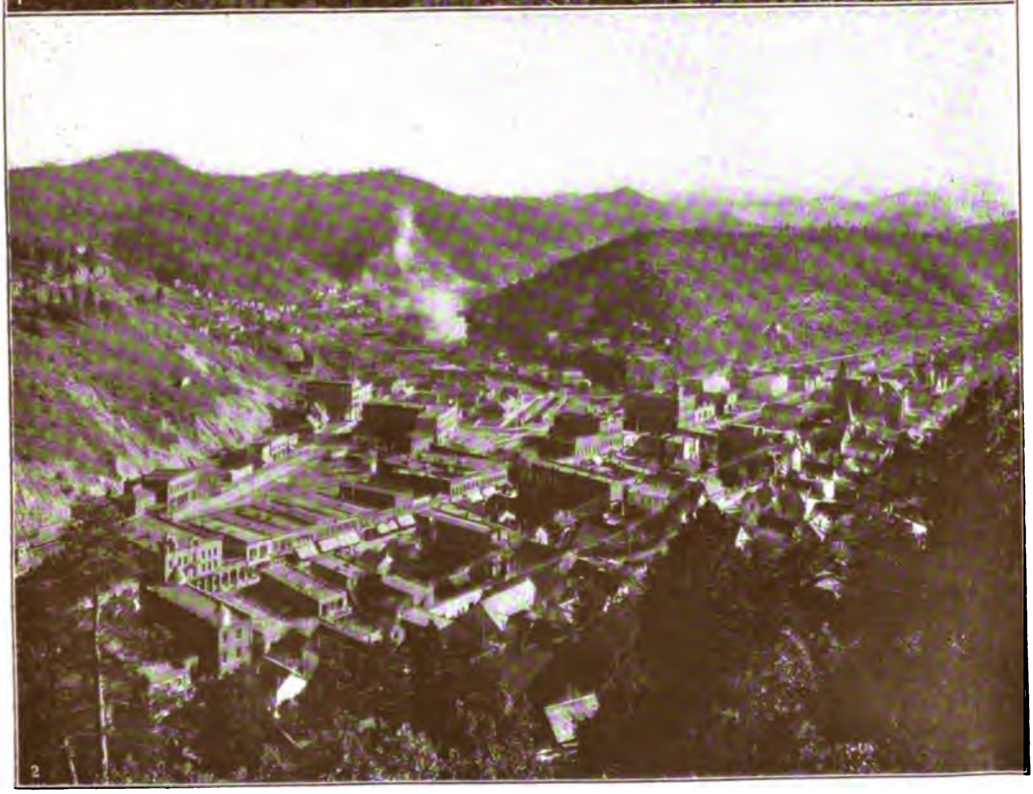
J. W. Heston,
President South Dakota Agricultural College.

South Dakota Agricultural College, the State school of agriculture and technology, situated at Brookings, S. Dak. It was first opened in 1884, and is under the control of the same board of regents as the University of South Dakota (q.v.). It is co-educational. Courses are offered in agriculture, veterinary science, dairying, mechanical, electrical, and chemical engineering, architecture, domestic science, and general science; in addition to these technical and scientific courses there is a normal course, a business course and a preparatory department. Military drill is also a part of the curriculum. Formerly two courses in agriculture were offered; in the year 1901-2 one course in agriculture was substituted for the two; this course requires work in one language, and includes certain practical studies not before offered, such as stock judging, blacksmithing, horseshoeing, etc. The degree of B.S. is conferred. The college farm and grounds contain 400 acres; in 1901 a new physics and engineering building and a plant-breeding building were erected. The income is derived mostly from State appropriations and from the annual Federal appropriation in accordance with the law of 1890. The State agricultural experiment station which is connected with the College, receives a separate Federal appropriation.

South Dakota State School of Mines, located at Rapid City, S. Dak. It was first opened in 1886 and is under the control of the same board of regents as the State University and the State Agricultural College. It has a preparatory department, and in its higher department offers only one course, that in mining engineering. It is open to women. Its income is derived mostly from State appropriations, the tuition fee being small. The students in both departments in 1910 numbered 65.

South Dakota, University of, the State university located at Vermilion. The first terri-

Digitized by Google



1. The Famous Homestake Mine, at Lead City.
2. The City of Deadwood.

Digitized by Google

Digitized by Google

torial legislature of Dakota located the University of Dakota at Vermilion in 1862; nothing further was done toward establishing the institution until 1881, when Congress granted 86,000 acres to Dakota for a university when the Territory should be admitted to the Union as a State; the citizens of Vermilion then erected a building and organized an academic department. This action was ratified by the legislature in 1883, the building accepted as a gift to the Territory, and the University incorporated. The first classes were opened in 1883. In 1891 the name was changed to University of South Dakota. The departments include the preparatory and college department, the College of Business, and the College of Music. The regular college courses lead to the degree of A.B., normal courses are offered, and in 1901-2 courses in civil and mechanical engineering were added. Military drill and instruction in military science are a part of the curriculum. The University admits women on equal terms with men. The government is by a board of five regents appointed by the governor and confirmed by the senate for a term of six years. The State geological survey is conducted in connection with the University. The income of the University is derived mostly from the Congressional land grant of 86,000 acres of which it now has control, and from State appropriations; tuition fees are small; the income in 1910 amounted to $188,000. The library in 1910 contained 17,000 volumes, the students numbered 450 and the faculty 46.

South Georgia Islands. See Georgia, South.

South Had'ley, Mass., a town, Hampshire County; on the Connecticut River, and on the Boston & M. and the New York, N. H. & H. R.R.'s; 14 miles north of Springfield. The town includes the two villages of South Hadley and South Hadley Falls. It was first settled in 1726-7, was originally a part of the town of Hadley, and was separately incorporated in 1753. The river here has a fall of 40 feet, that affords power for manufacturing; the first paper mill was established in 1848; the town now contains paper mills, woolen and cotton mills, and saw-mills. There is a public library, and a public high school; the town is also the seat of Mount Holyoke College (q.v.). Pop. (1910) 4,894.

South Holland, Netherlands, a maritime province, bordering on the North Sea and bounded north by the province of North Holland, east by Utrecht, and south by North Brabant. Area, 1,166 square miles. Pop. about 1,200,000. See Netherlands.

South Island. See New Zealand.

South Ken'sington Museum, an institution in London originated by the Prince Consort in 1852, and under the direction of the Committee of Council of Education. It contains a rare collection of ancient and modern art as applied to manufactures, a gallery of British art, an extensive collection of water-color paintings, a collection of sculpture, reproductions of ancient sculptures, and an art library. Other departments contain collections of substances used for food, and of materials employed in building and construction. The loan department is a special feature in connection with the institution. There is also a national art training school, and schools of science and cookery.

South Kensington, National Art Schools of, London, England, connected with the Victoria and Albert, or (colloquially) South Kensington Museum, in Brompton, south of Hyde Park, are under the direction of the Department of Science and Art. They have the advantage of special admission to the priceless collections of all kinds in the museum, which are carefully arranged for purposes of instruction. See London.

South Kingstown, R. I., town, Washington County; on the southeastern coast, and on the New York, New Haven & Hartford railroad. The town of Kingstown was settled and incorporated as early as 1674; it was divided into North Kingstown and South Kingstown in 1723. The colonial assembly met at South Kingstown at various times, and in 1790 the convention called to decide on accepting the United States Constitution met here, but voted to adjourn to Newport. In 1780 South Kingstown was one of the wealthiest towns in the State; in 1900 the census reported 71 manufacturing establishments with a capital of $1,697,485; the industries include cotton mills and machine shops. Pop. (1910) 5,176.

South Mills, Battle of. In the fore part of April 1862, after the capture of Roanoke Island and Newbern, rumors reached Geo. Burnside at the latter place that the Confederates were building iron-clad gunboats at Norfolk, Va., with the intention of running them through the Dismal Swamp Canal and Roanoke River to make a descent upon the Union flotilla in Albemarle and Pamlico Sounds. Burnside, in co-operation with Commander Rowan of the navy, organized an expedition to move on South Mills, near Camden, destroy the locks of the canal at that point, and the Currituck Canal by blowing up its banks, thus rendering it impossible for the gunboats to come into the sounds. Another object of the movement was to create the impression that the entire Burnside expedition was moving on Norfolk, less than 40 miles distant. The expedition was put under command of Gen. J. L. Reno, who, with the 21st Massachusetts and 51st Pennsylvania, sailed from Newbern to Roanoke, where on 18 April he was joined by Col. Hawkins' brigade (9th and 89th New York and 6th New Hampshire) with four guns. In all Reno had about 3,200 men. The transports, accompanied by gunboats, sailed up the Pasquotank River, and about midnight of the 18th Hawkins' brigade began a landing on the east side some four miles below Elizabeth City, which is on the west side. At 3 A.M. of the 19th Hawkins' brigade had been landed and was ordered forward, Reno remaining to bring up the other two regiments, which had been delayed by the grounding of some of the transports. Hawkins, misled by a guide, had marched by a circuitous route, and was overtaken by Reno, some 12 miles out, and Reno took the advance, Hawkins' fatigued brigade following. After marching about four miles, and when within two miles of South Mills, Reno's advance came under an unexpected fire of artillery and was brought to a halt. Reno pushed his guns into action. Col. A. R. Wright, of the 3d Georgia, 585 strong, some drafted North Carolina militia, a company of local cavalry, in all about 750 men and four

Digitized by Google

guns, had taken position across the road. His artillery commanded the road, was supported by infantry in a deep ditch, along which rails were piled, with open ground in front and a dense wood in rear. Skirmishers covered both flanks, which were in the woods. After an artillery duel of an hour Reno ordered the 51st Pennsylvania and then the 21st Massachusetts through the woods on the right to turn the Confederate left, and Hawkins, having come up, was ordered, with the 9th and 89th New York, to follow the two flanking regiments to the right, the 6th New Hampshire being placed on the left of the road to support the artillery. The 51st Pennsylvania and 21st Massachusetts, reaching the Confederate left, opened fire and about the same time the 9th New York, breaking from the woods, made a gallant charge — Reno says an "unauthorized and unnecessary" one — over the open ground upon the Confederate guns, and being met with a severe fire of canister and musketry, was repulsed, but made a quick rally on the 89th New York, and both went forward to join the 21st Massachusetts, which, with the 51st Pennsylvania, had kept up fire, forcing the Confederates to withdraw their guns and retire a mile, upon support that was coming up. On the left of the road the 6th New Hampshire had made a gradual advance to within 200 yards of the right of the 3d Georgia and, pouring in a volley, hastened its retreat. The fight lasted nearly four hours. At 10 P.M. without accomplishing the principal object of his expedition, Reno marched back to his boats, and the troops returned to their stations on Roanoke Island and Newbern. The Union loss was 13 killed, 101 wounded, and 13 missing, an aggregate of 127, of which 75 were lost by the 9th New York. The Confederate loss was 6 killed, 19 wounded, and 3 missing. Consult: 'Official Records,' Vol. IX.; The Century Company's 'Battles and Leaders of the Civil War,' Vol. I. E. A. CARMAN.

South Mountain, Battles of. When Gen. Lee led the Confederate army across the Potomac into Maryland (5 Sept. 1862), east of the Blue Ridge, he expected that the Union troops holding Winchester, Martinsburg, and Harper's Ferry would be withdrawn, thus opening his line of communication through the Shenandoah Valley. Upon his arrival at Frederick, much to his surprise he found that this had not been done; and as an uninterrupted line of communication through the valley was an absolute necessity for his intended campaign into Pennsylvania, prompt measures were taken to secure it. On the morning of the 10th Jackson, with 14 brigades, marched from Frederick, passed over South Mountain at Turner's Gap, crossed the Potomac at Williamsport, on the 11th, drove the Union garrison at Martinsburg into Harper's Ferry, and proceeded to invest that place from the Virginia side of the Potomac. McLaws, with 10 brigades, crossed the South Mountain at Brownsville Gap, and seizing Maryland Heights, invested Harper's Ferry from the Maryland side. Walker's division crossed the Potomac at Point of Rocks and seized Loudoun Heights. (See HARPER'S FERRY; MARYLAND CAMPAIGN OF SEPTEMBER 1862.) Lee followed Jackson through Turner's Gap; D. H. Hill's division was left at Boonsboro, to support Stuart's cavalry, which was to hold Turner's Gap and watch McClellan; and with the divisions of D. R. Jones and J. B. Hood, and the reserve artillery, all of Longstreet's command, Lee marched to near Hagerstown to await the result of the movement on Harper's Ferry, and the subsequent concentration of his widely dispersed command for the movement into Pennsylvania.

The advance of McClellan's army reached Frederick on the 12th. Before noon next day there was found in the abandoned Confederate camp the order, known as "Order 191," for the movements of Lee's army for the 10th. The copy was from Lee to D. H. Hill, and showed the position of every division of Lee's army, and what it was expected to do, that at the time Jackson, McLaws and Walker were investing Harper's Ferry, and that Lee, with Longstreet and D. H. Hill, was beyond Turner's Gap. It was not later than noon when McClellan had this valuable paper placed in his hands, but he did not act promptly upon it. It was not until 3 P.M. that he ordered Pleasonton, then near Middletown, to ascertain whether the Confederates had moved in the direction indicated in the order. At 3.35 P.M. Cox's division of the Ninth corps was ordered to march from Frederick to Middletown and support Pleasonton's cavalry in a reconnoissance to Turner's Gap. Pleasonton advanced toward Turner's Gap, and found his progress checked by Stuart's cavalry. It was late in the day when McClellan had come to the decision to relieve the garrison at Harper's Ferry, and at the same time fall upon and destroy Lee's isolated command at Boonsboro. Franklin's Sixth corps and Couch's division were to move through Crampton's Gap of South Mountain, break the line of investment that McLaws had thrown across Maryland Heights and the foot of Pleasant Valley, thus relieving Miles at Harper's Ferry, and at the same time interpose between McLaws and that part of Lee's army at Boonsboro and Hagerstown. At the same time Burnside, with the First and Ninth corps, supported by the rest of the army, was to move through Turner's Gap and fall upon Lee, who it was thought had Longstreet and D. H. Hill at Boonsboro. It would have been well had these orders been given early in the afternoon of the 13th and the troops immediately put in motion for the passes of the mountain, but it was not so. The orders were to move next morning; meanwhile Pleasonton was to fire occasionally a few artillery shots, even though no enemy appeared in front, so that Col. Miles, at Harper's Ferry, would know that the Union army was near.

Battle of Crampton's Gap.— Gen. Franklin, who was at Buckeystown, six miles from Frederick, and between it and the Potomac, marched at 6 A.M. by way of Jefferson, where he halted an hour for Couch's division to join him from Licksville, but Couch not coming up, he resumed the march, and at noon halted two miles short of Burkittsville, which lay half a mile from the foot of Crampton's Gap. The Gap was thought to be strongly held, and Franklin made elaborate preparations to carry it. In fact the Gap was held by two small cavalry regiments, part of Mahone's brigade of infantry, and two batteries, in all about 900 men, under Col. T. T. Munford. Semmes' brigade, with five

Digitized by Google

guns, held Brownsville Gap, one mile south of Crampton's, and 300 of Semmes' men closely supported Munford's right; so, to meet the attack of Franklin's column of nearly 12,000 men, Munford had 1,200 infantry and dismounted cavalry posted behind stone fences and houses at the east foot of the gap, with eight guns in position on the winding road about half way up the mountain. It was determined that the position should be carried by assault, Gen. Slocum's division advancing on the right of the road leading through the gap to make the assault, supported by two brigades of Gen. Smith's division moving on the left of the road. It was 3 o'clock before Slocum's division had been formed, in two lines. Bartlett's brigade on the right, Newton's in centre, and Torbert's New Jersey brigade on the left. The day was well spent when the order was given to advance, and the skirmishers pushing forward drew the fire of the Confederates posted behind the stone fences and houses; which, with the fire from the artillery on the mountain side, was so severe, that the advance was suspended until artillery could be brought up to silence that of the Confederates and batter down the stone fences. The artillery was slow in coming up, Smith had not advanced on the left, the men were becoming restive under the hot fire being poured upon them, and without waiting for the artillery to come up or Smith to close up on the left, the three brigade commanders after a hurried consultation, and without orders from corps or division commander, ordered a charge, which was gallantly made. The fire poured upon the line was severe, and some of the regiments were momentarily shaken, but the stone fences were carried and the Confederates driven up the steep hill, the Union line, much broken, closely following. When nearing the crest of the hill, Cobb's Georgia brigade, which had just come up to support Munford, was encountered in the gap, instantly routed, most of it captured, and the Union troops pursued the retreating Confederates to the west foot of South Mountain, when darkness halted them. The Union loss was 113 killed, 418 wounded, and 2 missing. The Confederate loss was 70 killed, 289 wounded, and 603 captured or missing. In addition they lost four colors, one gun, and 700 small arms.

Battle of Turner's Gap.— While Franklin was forcing Crampton's Gap, Burnside, with the First and Ninth corps, was severely engaged at Turner's Gap, six miles northeast of Crampton's. The engagement was most severe at and south of Fox's Gap, a mile or more south of Turner's, and there was a fierce contest north, but as both were for the possession of the main road, which ran through Turner's Gap, this has given the Union name to the battle — the Confederates call it the battle of Boonsboro. On the night of the 13th Pleasonton, failing to get infantry support, bivouacked in the valley, near the foot of Turner's Gap, and early in the morning pressed his reconnoissance and soon ascertained that the Confederates were in some force in the Gap. Two batteries of artillery were brought up, and opened fire upon Confederate artillery well up in the Gap; and Cox, whose division had bivouacked near Middletown, advanced a short distance on the main road, and then with two brigades marched to the left on the old Sharpsburg road to reach the flank of the Confederate position. As he approached Fox's Gap, one mile south of Turner's, he received artillery fire. D. H. Hill, whose five brigades had been halted near Boonsboro, three miles west of Turner's Gap, when informed by Stuart that Pleasonton was advancing, on the 13th sent two brigades and two batteries back to assist Stuart in checking him. At midnight he received an order from Lee to go in person next morning and assist Stuart. When Hill arrived at the gap before sunrise Stuart had gone to Crampton's Gap and Maryland Heights, leaving Garland's and Colquitt's brigades of Hill's command to defend the gap. It was not long before Hill became aware that Cox was marching on the road to Fox's Gap, held by Col. Rosser with a regiment of cavalry and two guns. Garland's brigade was sent to Fox's Gap, Colquitt's retained at Turner's, and Anderson's ordered up from Boonsboro. Garland had not been long in position before Cox appeared and attacked him; and after a severe fight, in which Garland was killed and Lieut.-Col. R. B. Hayes of the 23d Ohio wounded, Garland's brigade was routed, and Cox gained the crest of the mountain, just south of Fox's Gap, but could not seize the gap, for at the moment of his victory G. B. Anderson's brigade came up and formed in front and on his right, covering the road through the gap. Learning from prisoners taken that D. H. Hill, with five brigades, was in his front, and that Lee was hastening from Hagerstown, with Longstreet's command, Cox withdrew his advance parties from the woods into which they had charged, and forming line just under the crest of the ridge, awaited reinforcements. The first reinforcement was Willcox's division, which came up at 2 P.M. and, forming on Cox's right, covered the road through Fox's Gap. Meanwhile other Confederate troops had come up and were coming up to form in Cox's front. Hill had called Ripley's and Rodes' brigades from Boonsboro, and thrown Ripley in front of Cox, and Rodes to a hill north of Turner's Gap. Gen. Lee, leaving Toombs' brigade near Hagerstown, marched back from there with the brigades of G. T. Anderson, Drayton, Kemper, Garnett, Jenkins, Evans, and the two brigades of Hood's division. After a hot and dusty march of 13 miles, Anderson and Drayton, first arriving, reached the field at 3 P.M., and were sent to support Hill's troops at Fox's Gap, and Drayton, on the left of the line thus formed, advancing from the woods at the gap, was encountered by Willcox, defeated, and driven from the field with great loss, more than half of his brigade being killed, wounded, and captured. Heavy skirmishing followed all along the line, Sturgis' division came up and partly relieved Willcox, and near sunset Gen. Reno came up, with Rodman's division, one of whose brigades, with a battery, was sent to Cox's extreme left, the other held on the right. Reno rode forward to reconnoiter just to the right of the gap, as Hood's division came up on the Confederate left; there was a scattering fire on both sides; and Reno, commanding the Ninth corps, was killed. At about the same time the right of the Confederate line charged upon the left of Cox's line, held by Fairchild's

Digitized by Google

brigade and Clark's battery, and their quick repulse ended the engagement at Fox's Gap, with the Confederates still holding the gap. The loss of the Ninth corps in this engagement, which continued from 9 A.M. until after sunset, was 157 killed, 691 wounded, and 41 missing. The Confederate loss in Cox's front was about 600 killed and wounded, and as many more captured.

During the latter part of Cox's engagement at Fox's Gap Gen. Hooker became severely engaged north of and at Turner's Gap. At daybreak of the 14th Hooker led the First corps from the Monocacy through Frederick and Middletown to Catoctin Creek, where he halted at 1 P.M. for rest and coffee. Under instructions to attack the heights north of Turner's Gap and create a diversion in favor of Cox, he marched by the National road leaving over Turner's Gap, turned to the right at Bolivar and, marching nearly two miles, halted and formed line at the eastern base of South Mountain, about 3.30 P.M.: Meade's division on the right, Hatch's on the left, with Ricketts in reserve. Gibbon's brigade of Hatch's division was left on the National road to advance directly into the gap. In Hooker's front the slopes to the crest of the mountain were very precipitous, rugged, and partly wooded, bisected by gorges and small ravines, all presenting difficult ascent to an infantry force, even in the absence of a foe in front. At the time there was a veteran foe in front, well protected by rocks and trees, and the numerous stone fences separating the fields. The position to be assaulted was held by the brigades of Rodes, Kemper, Garnett, Evans, and Jenkins, all under command of Longstreet. Hooker was very deliberate in his preparations, and it was after 4 P.M. when his line moved forward. Hatch, on the left, made a laborious ascent of the mountain, with frequent halts to draw breath and reform his line; but driving in the Confederate skirmishers, he reached the wooded summit, and after severe fighting, in which he was wounded, succeeded in dislodging the Confederates from the stone fences behind which they had fought, and driving them back to another line. In this he had the assistance of a part of Ricketts' division. On Hatch's left Gibbon advanced on the road to the gap, and when near it was checked, after a very stubborn fight, by Colquitt's brigade. It was dark when Hatch and Gibbon ceased fighting, both close up to the gap. On the right Meade's route lay over very broken ground, but crossing ravines, ascending steep hills, and charging stone fences, he drove Rodes' brigade and its support from point to point, as it extended to the left, and finally turning it, swept to the left and reached the highest point of the mountain, commanding the summit of the gap, the road through it, and the narrow open space around the Mountain House, on which Lee's defeated men were crowded in some disorder. It was dark when this position had been gained, and Hooker rested. He had lost 167 killed, 712 wounded, and 44 missing. The total Union loss for the possession of Turner's Gap, including Fox's Gap, was 325 killed, 1,403 wounded, and 85 missing; the Confederate loss, 248 killed, 1,013 wounded, and 662 missing.

The result of the battle was that Lee abandoned his intended invasion of Pennsylvania and ordered an immediate retreat to Virginia. At 8 P.M. he ordered McLaws to abandon his position during the night and recross the Potomac near Shepherdstown Ford, leaving that ford for Longstreet's and Hill's commands, and about the same hour sent a despatch to Jackson to march up the Virginia side of the Potomac to Shepherdstown Ford, to protect his crossing. These orders to McLaws and Jackson contemplated the abandonment of operations against Harper's Ferry. The trains, reserve artillery, and reserve ammunition train, at Hagerstown, were ordered to cross the Potomac at Williamsport, and Toombs' brigade was ordered to mach from Hagerstown to Sharpsburg. Between 10 and 11 P.M. Lee's army began its retreat from South Mountain by way of Boonsboro and Sharpsburg, D. H. Hill leading, with orders to cross the Potomac. While on the march Lee heard that Franklin had carried Crampton's Gap, thus shutting up McLaws in Pleasant Valley, upon which he ordered his column to halt at Keedysville to assist McLaws, who was now ordered to cross Elk Ridge, if possible, and join him at Keedysville or Sharpsburg, or to cross the Potomac at Weverton, below Harper's Ferry. Arriving at Keedysville, he could hear nothing of McLaws, and at daylight, 15 September, resumed his march for Sharpsburg, still hoping that McLaws could elude Franklin by crossing Elk Ridge. Before reaching Sharpsburg he heard that Harper's Ferry had fallen, and when across the Antietam he received a despatch from Jackson stating that he would join him at Sharpsburg, upon which he concluded to give McClellan battle at that place, and immediately made dispositions to contest McClellan's passage of the Antietam, until Jackson, Walker, McLaws, and Anderson could join him, by marching up the Virginia side of the Potomac. Consult: 'Official Records,' Vols. XIX.–LI.; 'McClellan's Own Story'; Palfrey, 'The Antietam and Fredericksburg'; Allan, 'History of the Army of Northern Virginia in 1862'; The Century Company's 'Battles and Leaders of the Civil War,' Vol. II.

E. A. Carman.

South Norwalk, nôr'wâk, Conn., city, Fairfield County; on Long Island Sound at the mouth of the Norwalk River, and on the New York, New Haven & Hartford railroad; about 30 miles west by south of New Haven and 40 miles northeast of New York. The harbor is safe and large enough for the Sound steamers; the city has regular connection by steamer with many of the Sound ports; especially freight connection with New York.

The surface of the city is irregular, it rises from the water and in the northwestern part reaches an altitude of 160 to 165 feet. The residential portion of the town is on the elevation. The chief industrial establishments are paper-box factories, boot and shoe factories, hat factories, machine shops, bronze goods works, steam-engine and pump works, stone and earthenware works. Other manufactures are air-compressors, locks, wooden ware, and household goods. There is some ship and boat building, and considerable attention is given to the cultivation of oysters. The principal public buildings are the large and well-built schools, the municipal buildings, and the churches. There

Digitized by Google

is a public library, which was opened in 1877. The two national banks have a combined capital of $200,000; there is one savings bank. Pop. (1910) 8,968.

South Omaha, Neb., city in Douglas County; on the Missouri River, and on the Chicago, B. & Q., the Chicago, R. I. & P., the Fremont, E. & M. V., the Missouri Pacific, and the Union Pacific R.R.'s. Omaha (q.v.) is on its northern boundary. Seymour Park on the southwest, and the "Fair Grounds" on the west. It has steamer connection with many of the cities and towns on the Missouri, thus adding to its shipping facilities, especially the opportunities for cheap freight transportation. It was chartered as a city in 1885.

South Omaha is practically a suburb of Omaha; its largest industrial interests are controlled mainly by Omaha firms and corporations; but the city has an independent municipal government. The plant of the Union Stock Yards Company, located here in 1884, is one of the largest stock markets in the country. The city is the greatest slaughtering and meat-packing centre in the United States, next to Chicago and Kansas City. The government census of 1900 gives as the number of manufacturing establishments, 139; the total amount of capital invested in manufacturing, $16,471,329; the number of employees (not officials), 6,606; annual wages, $3,268,591; the amount paid for material, $61,277,486; and the value of the product, $70,080,941. The five wholesale slaughtering and meat packing establishments had (1900) invested a capital of $15,635,418; and the number of employees was 5,938. The annual wages paid the employees was $2,914,217. The amount paid annually for material was $60,021,201, and the value of the product was $67,716,724. A high school was established in 1887 and the public and parish elementary schools are well organized and equipped. Pop. (1910) 26,259.

South Orange, N. J., village in Essex County; on the Rahway River, and on the Delaware, Lackawanna & Western railroad; 5 miles west of Newark, and 15 miles west of New York. It was first settled in 1680, and was a part of the town of Newark until 1806, when the town of South Orange was separately incorporated. It is picturesquely situated among the Orange Mountains, and has many fine residences, being a favorite place of residence for New York business men. Though largely a residential village, it has manufactures of hats and gelatin. It contains a handsome town hall (completed 1895) a public library, a public high school, and a Roman Catholic parish school. It is also the seat of two private schools for girls, and of Seton Hall College (q.v.), a Roman Catholic institution. Pop. (1890) 3,106; (1900) 4,608; (1910) 6,014.

South Polar Explorations. See POLAR RESEARCH.

South Portland, Maine, city, Cumberland County; in the southwestern part of the State on the south side of Portland harbor; connected with Portland by electric railway. It was originally a part of Cape Elizabethtown, and was separately incorporated as a city in 1889. It is in an agricultural district and the chief business of the city is derived from farming; it contains also marine equipment and iron and steel plants, and a small shipbuilding yard. It has a public high school, and is the seat of the State Reform School. The city government is vested in a mayor and a council of seven members elected annually.

C. H. BARKIN,
Postmaster.

South Sea. See PACIFIC OCEAN.

South Sea Bubble, The, a disastrous financial speculation which arose in England in the beginning of the 18th century. It originated with the directors of a joint-stock company, which, in consideration of certain exclusive privileges of trading to the South Seas, offered the government easier terms for the advance or negotiation of loans than could be obtained from the general public. In 1720 the proposal of the company to take over the entire national debt (at this time about $150,000,000) in consideration of receiving annually 5 per cent, was accepted, and the company promised on return for this privilege (as it was regarded) a premium in their own stock of $35,000,000. Professing to possess extensive sources of revenue the directors held out promises to the public of paying as much as 60 per cent on their shares. It became soon apparent that such magnificent promises could never be fulfilled, and in a few months' time the collapse came which ruined thousands.

South Sea Company, The. See SOUTH SEA BUBBLE, THE.

South Shetland Islands, Antarctic Ocean, a group of islands situated between lat. 61° and 63° 20′ S., and between lon. 54° and 63° W., off the north coast of Graham Land, and 600 miles southeast of Cape Horn. The group consists of 12 larger and numerous smaller islands, which are rocky and mountainous. They were discovered by the Dutch navigator Dirk Gerrits in 1599.

South, University of the. See UNIVERSITY OF THE SOUTH.

Southampton, south-ămp'tŏn or sŭth-hămp'ton, England, an important seaport town in Hampshire, 71 miles southwest of London, on the innermost angle of the SOUTHAMPTON-WATER. Other streams almost surround the town, which occupies an acclivity and consists of two distinct parts. The walls of the older part belonging to the Middle Ages, traverse the centre of the town and divide it from the modern portion. The gates of this ancient wall are quite remarkable; Bargate is embattled and machiolated, and contains in its upper part the Guild Hall. Saint Michael's is an old Norman church with some fine stained glass and delicate traceries, and a lofty tower. *Domus Dei* is an ancient hospital of the 12th century, whose chapel was for some time used by French Protestant refugees. The Royal Victoria Hospital is about six miles from the town at Netley near the ruins of a celebrated abbey. It was founded by Queen Victoria for soldiers of the foreign service, as well as those nearer home, at a cost of $1,750,000. A medical school is attached to it, for the preparation of surgeons for the army medical staff; it is also headquarters for women army-nurses who are trained here for their profession. Other buildings are Holyrood and Saint Mary's churches, the town-hall, custom-house, Watts memorial hall, philhar-

Digitized by Google

monic hall, assembly-rooms, ordnance survey offices, baths, etc. Literary institutions include the free library and grammar school (1550); Trade School; Hartley College, founded for the advancement of the natural sciences, archæology, classical and oriental literature, and connected with the schools of Art and Science at South Kensington; Polytechnicum, Athenæum, and theatres. The docks are extensive (250 acres), and the harbor one of the finest in the world. The Prince of Wales' dock is the largest single dock extant. There are carriage manufactories, machine works, breweries and distilleries; ship-building and a cattle market. The trade of the port is enormous. The imports are corn, meat, cheese, fruit, coffee, sugar, cattle, wool, hides and wood. Exports: cotton manufactures, leather, hats, hardware, books and clothes. There are fine parks in the town and Southampton Common, nearby, is a large tract which contains the race-track. Southampton was founded by the Saxons and preserves much of its antique character. Pop. about 110,000.

Southard, suth'ard, **Samuel Lewis,** American statesman: b. Baskingridge, N. J., 9 June 1787; d. Fredericksburg, Va., 26 June 1842. He was graduated from the College of New Jersey in 1804 and was afterward admitted to the bar of Virginia. In 1815 he was appointed associate justice of the supreme court of New Jersey in which capacity he served until 1821, when he was elected to the United States Senate. In 1823 he was made secretary of the navy, and in 1829 held the same office in the cabinet of John Quincy Adams. He was appointed attorney-general of New Jersey in 1829, and elected governor of that State in 1832, and was a member of the United States Senate 1833-42.

South'bridge, Mass., town in Worcester County; on the Quinnebaug River, and on the East Thompson branch of the New York, New Haven & Hartford railroad; about 71 miles southwest of Boston, and 21 miles south by west of the city of Worcester. It was settled about 1730 by people from Medfield, and included Sturbridge, Charlton and Dudly until 1801. It was incorporated as a poll-parish 28 Feb. 1801, as a town in 1816. The chief manufacturing establishments are optical works, shuttle works, woolen and cotton mills, knife works, and printing works. The government census of 1900 gives the number of manufacturing establishments 109; the capital invested, $4,269,358; wage-earners in manufactories, 2,871; annual wages paid, $1,225,064. The raw material for 1900 cost $1,884,004; and the output was valued at $3,854,638. Since 1900 the number of wage-earners, and the output have greatly increased. The town is an industrial and commercial centre of great importance. The principal public buildings are the town hall, public library, the Y. M. C. A. building, the churches and schools. There are seven churches, a high school, public and parish schools, and a fine public library. The government is administered by annual town meetings. The French Canadian element predominates. Pop. (1900) 10,025; (1910) 12,592.

WM. T. ROBINSON,
Editor 'Southbridge Herald.'

South'cott, Joanna, English fanatic: b. Gittisham, Devonshire, April 1750; d. London 27 Dec. 1814. For many years she was in domestic service, attending the Established Church, but also going to Wesleyan meetings. In 1791 she joined the Methodists, but in 1792 left them, and began to write prophecies in a combination of doggerel verse and incoherent prose. Converts followed the publication of her tract, 'The Strange Effects of Faith,' in 1801; the elect were to number 144,000, and their certificates for the millennium were drawn up. Joanna professed to interpret dreams, and many absurdities and delusions attended her proceedings until her death by a brain disease. Her followers split into two minor sects, led respectively by John Ward and John Wroe. Consult: Aikin (Pugh), 'Memoirs of Religious Impostors' (1821); Mathias, 'The Case of Joanna Southcott.'

South'cottians. See SOUTHCOTT, JOANNA; RELIGIOUS SECTS.

Southdown, a breed of sheep (q.v.).

Southend', or **Southend-on-Sea,** England, in Essex County, on the Thames, 42 miles east of London. The public buildings are the theatre, church and hall. The marine park contains 26 acres, a revolving tower, pavilions, etc. Westend is an attractive suburb, with many pretty villas. Southend is the chief station of the coast survey and is above all, a much-frequented watering-place — the one nearest London. Its popularity began with a visit by Queen Caroline in 1804. The bathing is excellent. It has a fine pier and esplanade, and a lighthouse. Pop. about 30,000.

Southern Baptist Theological Seminary, located at Louisville, Ky. It was established by the Southern Baptists to provide an institution expressly for theological training, and was opened in 1859 at Greenville, S. C. During the Civil War it was closed, and reopened in 1865 under serious financial difficulties. In 1877 it was removed to Louisville, but the financial resources were precarious until 1880 when a large donation was received and the success of the institution assured. The course of instruction is divided into the following nine schools: (1) Biblical introduction; (2) Old Testament interpretation; (3) New Testament interpretation; (4) systematic theology; (5) comparative religion and missions; (6) homiletics and elocution; (7) church history; (8) ecclesiology; (9) pastoral theology. Of these schools, three have two departments; the school of Old Testament interpretation includes an English and a Hebrew department, the school of New Testament interpretation, an English and a Greek department, the school of systematic theology, a general course and a department of Biblical theology; the Hebrew, Greek and Biblical theology courses are intended for students who have had a higher education, some preparation in Greek being necessary for the Greek course. There are also special courses for advanced work in each department. The degrees conferred: Th.G., (graduate in theology), Th.B. (bachelor in theology), Th.M. (master in theology), and Th.D. (doctor in theology), the last for post-graduate work after the acquirement of the degree of Th.M. The buildings include New York Hall (a dormitory), Norton Hall, the Memorial Library Building and the Gymnasium. The library in 1910 contained 25,000 volumes; the students numbered 300 and the faculty 10.

Digitized by Google

Southern Cross, in astronomy, a constellation of the southern hemisphere, composed of four stars, one of which is of the first, and two of the second magnitude. They form a figure not unlike a cross, especially when seen above the pole, and are the best-known of the southern constellations.

Southern Cross, Imperial Order of. See ORDERS, ROYAL.

Southern Education Board, The, organized as an outcome of the Capon Springs and Winston-Salem conferences, and having for its object the awakening and molding of public opinion for the betterment of education and the securing of educational legislation in the South. See GENERAL EDUCATION BOARD.

Southern Railway Company. The Southern Railway Company was chartered under the laws of Virginia, 1894, as successor to the Richmond & West Point Terminal Railway & Warehouse Company. It operates main lines in Virginia, North Carolina, South Carolina, Georgia, Tennessee, Alabama, Mississippi, Kentucky, Indiana, and Illinois. There are also branches and spurs in these States, also in the District of Columbia. The main lines extend 3,002 miles, and the branches and spurs, 1,495 miles. The road covers, with its leased lines and trackage rights, practically all points of importance in the South Atlantic and Gulf States.

The Southern Railway, by its ownership of securities, controls the following leased lines: Southern Railway, Carolina division, 714 miles; Mobile & Birmingham Railroad, 150; Richmond & Mecklenburg Railway, 31; Georgia Midland Railroad, 98. The lines controlled but not leased are: the State University Railway, 10 miles; North Carolina Midland Railway, 54; High Point, Randleman, Asheboro & Southern Railway, 27; Yadkin Railroad, 44; Elberton Air Line Railroad, 51; Knoxville & Ohio Railroad, 69; Sievern & Knoxville Railroad, 17; Atlantic & Yadkin Railroad, 165, and Ensley Southern, 28. The above group gives a total of 5,838. Other lines leased and trackage rights brings the aggregate length of line controlled by the Southern Railway Company, as above, to 7,137 miles.

Other Lines Acquired.— In March, 1901, control was acquired of the Mobile & Ohio Railroad, which, with its tributaries, adds over 1,000 miles to the total, as follows: Alabama Great Southern Railroad, 357 miles; Cincinnati, New Orleans & Texas Pacific Railroad, 336; Georgia Southern & Florida, 285; Northern Alabama Railroad, 119. The Central of Georgia Railroad (q.v.), also controlled by the Southern Railway interests, operates over 3,276 miles of road, of which 1,399 miles are owned in fee and 1,877 miles are leased.

The Alabama Great Southern Railroad is controlled by the Southern Railway Company through ownership of the majority of each class of the capital stock of the Alabama Great Southern Railway Company, Limited. The Southern Railway Company controls the Mobile & Ohio Railroad through ownership of more than 64 per cent of its capital stock and about 84 per cent of its general mortgage bonds. The Georgia Southern & Florida Railway Company is controlled through ownership of more than 58 per cent of its capital stock and the entire issue of its 1st Consolidated Mortgage bonds. The above companies are operated independently.

Earnings and Expenses.— The total earnings of the Southern Railway for the year ending 30 June 1905, were: $48,145,000; operating expenses: $35,083,000; net earnings: $13,063,000; other income: $1,613; total net income: $14,675,000; total payments: $13,580,000; surplus: $1,095,000.

Increases.— The following increases are reported for the year ending 30 June 1905, over 1904: Increase in gross earnings: $3,305,000; expenses and taxes, $1,967,000; net earnings: $1,068,000; net income: $1,286,000; fixed charges: $315,000; improvements: $283,000; balance surplus: $668,000.

Stocks and Bonds.— The report for 1905 shows $120,000,000 outstanding of Southern Railway transfer certificates extended; $60,000,000 Southern Railway preferred 5 per cent T. C. extended; $5,670,200, Mobile & Ohio Transfer certificates.

The bonded indebtedness on the three groups just referred to is reported as $152,434,100. The rate per cent paid last dividend was 2½ per cent on the first two of the group and 2 per cent on the Mobile & Ohio transfer certificates. The highest stock quotations, 1904, for the first of the group was 37½; 1905, 38. Second of the group, 1904, 97½; 1905, 102½; third of the group, 1904, 98; 1905, 100¾.

The lowest stock quotations for the first of the group, 1904, was 18¼; 1905, 28. Second of the group, 1904, 77½; 1905, 95. Third of the group, 1904, 90; 1905, 97.

Descriptive.— The Southern Railway bisects North Carolina with its main line, from which many branches radiate to the cities of the State. Entering from the North, five miles below Danville, Va., the main stem runs southwesterly and passes into South Carolina just north of Blacksburg. A line from Norfolk runs through Danville, while another branch extends from Goldsboro (with connections from Wilmington and Morehead City) to Raleigh, Durham, University, Haw River, and Burlington, and intersects the main line at Greensboro. At Durham this line is joined by the branch from Keysville, through Chase City, Clarksville Junction, and Oxford. At Greensboro a branch, beginning at the west at Wilkesboro and passing through Winston-Salem (from which a branch runs to Mocksville), also intersects the main line. From High Point on the main line a branch runs to Asheboro, and at Salisbury that portion of the line running west to Asheville, Knoxville, and Chattanooga leaves the main stem.

The present Southern Railway routes include (1) to Atlanta, Montgomery, Mobile, and New Orleans. This is known as the route of the «Washington and Southwestern Limited»; (2) route to Florida by the Southern Railway New Short Line; (3) route to California via Washington, Atlanta, Montgomery, New Orleans, and the «Sunset route»; (4) route to the Pacific coast; (5) the route to the Texas oil field known as the New Orleans and Texas Route; (6) the route of the Washington and Chattanooga Limited and New York and Memphis Limited through Lynchburg, Bristol, and Chattanooga; (7) the route to Memphis, Tenn., Greenville, Miss., via Atlanta and Birmingham; (8) routes from Memphis to Arkansas and Texas: (a) Chicago, Rock Island & Pacific Railway; (b) Cotton Belt route; (c) Iron Mountain route; (9) route to Texas through Meridian, Jackson,

Digitized by Google

Vicksburg, and Shreveport; (10) route to Camden, Charleston, Summerville, Aiken, and Augusta; (11) route to Columbus, Ga., Macon, Ga., and Athens, Ga.; (12) route from New York to St. Louis, via Louisville; (13) route between New York and North Carolina; (14) route through the Sapphire Country; (15) route to Asheville, N. C., Nashville, Tenn., and Memphis, Tenn., Hot Springs, Knoxville, and Chattanooga; (16) route of the Southern Palm Limited between New York and St. Augustine, Aiken, and Augusta; (17) route to Jacksonville and Florida, west coast; (18) route to Savannah, Brunswick, Jacksonville, and Florida, east coast.

Additional routes by water under the control of the Southern Railway are by steamship to Central and South American ports, to Honolulu, to Key West, Havana, and Nassau, to South and Southwest via Norfolk, and to Old Point Comfort by the Chesapeake Steamship Company and the York River Line.

Southern Pacific Railroad Company. The Southern Pacific Railroad Company was created by special charter of the State of Kentucky in 1884. The organization of the company took place on 14 August of that year and active operations began on 1 March 1885. The general plan was conceived by the late Collis P. Huntington and carried out by him and a number of railroad men who were associated with him. The Southern Pacific Railroad, also known as the «Sunset, Ogden and Shasta Routes,» operates in Louisiana, Texas, New Mexico, Arizona, California, Nevada, Oregon, and Utah.

Mileage.— The total mileage of the system, 30 June 1905, is reported as 9,142 miles. The roads operated under leases aggregate 5,665 miles. These include the Southern Pacific Railroad proper (deducting the Mojave-Needles line, leased to the Atchison, Topeka & Santa Fe Railroad), aggregates 3,082; Southern Pacific Coast Railway, 101 miles; Central Pacific Railway, 1,460; Oregon & California Railroad, 672; New Mexico & Arizona Railroad, 88; Sonora Railway, 263.

The mileage of roads operated by their own organizations aggregates 3,470 miles. These include Morgan's Louisiana & Texas Railway, 328; Louisiana Western Railroad, 199; Texas & New Orleans Railroad, 440; Galveston, Harrisburg & San Antonio Railway, 917; Galveston, Houston & Northern Railway, 53; Houston, East & West Texas Railway, 191; Houston & Shreveport Railway, 39; New York, Texas & Mexican Railway, 177; Houston & Texas Central Railroad, 690; Carson & Colorado Railway, 300; Southern Pacific Railroad, 10; Iberia & Vermilion Railway, 16; Gulf, Western Texas & Pacific Railroad, 111. The aggregate mileage of the Southern Pacific Railroad increased from 4,705 miles in 1885 to 9,142 in 1905. The equipment in locomotives exceeds 1,700; passenger cars, 1,600; freight cars, 4,500.

Service.— The service of the Southern Pacific Railroad Company includes routes (1) between Salt Lake City, Utah, Ogden, Utah, Sparks, Nevada, and San Francisco, California; (2) in the San Joaquin Valley — between San Francisco and Los Angeles; (3) Coast Line — between San Francisco and Los Angeles; (4) Shasta Route — between San Francisco, Sacramento, and Portland. Other routes are (5) Kings River Canyon — via Visalia or Sanger; (6) Giant Forest; (7) Yosemite Valley — Wawona Route.

Earnings and Expenses.— The total earnings for the year ending 30 June 1905, including the water-lines, aggregated $95,515,000; operating expenses: $65,968,000; net earnings: $29,547,000. The increase in these receipts over 1885 exceeds $65,000,000. The increase in receipts over expenses and charges, 1904–1905, was $3,553,490.

History and Development.— Adverse political legislation in the southwestern States against railroad companies of a State being controlled by interests outside the State necessitated, at the time of organization, the adoption of a method whereby all of these companies might be brought under one control. A «Security-Holding Company,» called the «Southern Pacific Company,» was formed for the purpose. This was the first security-holding company organized to carry on extensive work.

During the years following incorporation the Southern Pacific Company gradually acquired and now owns the stocks and bonds which give it a controlling interest in the railway and railroad corporations mentioned in the first part of this article under *mileage.* By these stock acquisitions the Southern Pacific Railroad Company secured control of the lines as recorded; it also controls, through the Pacific Mail Steamship Company and several smaller corporations, about 16,180 miles of water routes on the Atlantic and Pacific Oceans. Its water lines extend from New York to New Orleans, and also from San Francisco to the Hawaiian Islands, Japan, and China.

Stocks and Bonds.— The total amount of stocks and bonds of the various subsidiary companies aggregate over $330,000,000 in par value of stocks and $327,000,000 in par value of bonds. Of these stocks, the Southern Pacific Railroad Company and its proprietary companies own $315,000,000 and of the bonds about $19,000,000. The capital stock of the Southern Pacific Company is reported as $200,000,000, of which there is outstanding $197,849,000. The par value of this stock is $100. The number of shareholders, Southern Pacific Railroad, 1905, is 2,424. The highest stock quotation, 1904, was 119½; 1905, 121⅛; lowest, 1904, 113; 1905, 115¾.

Funded Debt.— The direct Funded Debt of the Southern Pacific Company is reported to be as follows: $28,818,500 Collateral Trust 4's, due 1 August 1949; $2,215,000 First Mortgage Steamship 6's, due 1 Jan. 1911; $15,000,000 Collateral Trust 4½ per cent, due 1 Dec. 1905.

Central Pacific Railroad Interests.— The Central Pacific Railroad, which is the chief proprietary company of the system, was incorporated in Utah, July, 1899, as successor to the Southern Pacific Railroad, under a plan of readjustment by which the Southern Pacific Company acquired the entire capital stock and guaranteed the principal and interest of two new Central Pacific bond issues. The Central Pacific Railroad Common Stock, amounting to $67,275,500, is all held by the Southern Pacific Company, and the preferred stock (authorized issue $20,000,000 and outstanding $12,000,000) was delivered to the Southern Pacific Company in consideration of the latter issuing an equal amount of 4 per cent Collateral Trust bonds. The balance of preferred stock is reserved to be delivered only to provide additional funds, if required; for payment of 3 per cent notes to the

Digitized by Google

United States, and for betterment. The Central Pacific Railroad lines aggregate a mileage of 1,359.

Southern Pacific Railroad Interests.—The Southern Pacific Railroad, another of the proprietary companies, was incorporated 7 March 1902, as a consolidation of the Southern Pacific companies of California, Arizona, and New Mexico. Its outstanding stock aggregates $128,307,960, of which the Southern Pacific holds about $100,000,000. In the spring of 1902, the Union Pacific Railroad acquired about $90,000,000 of the capital stock of the Southern Pacific Company giving to the former corporation a strong working control.

Southerne, Thomas, English playwright and dramatist: b. in County Dublin, Ireland, about 1660; d. 26 May 1746. He was educated at Trinity College, Dublin, and entered the Middle Temple at London, but subsequently abandoned law to take up play-writing. His first play was 'The Loyal Brother, or The Persian Prince' (1682); this was followed by 'Isabella or the Fatal Marriage' (1894), which was afterwards revised by Garrick; 'Oroonoko, or The Royal Slave' (1696), one of the earliest English condemnations of the slave trade; 'Sir Anthony Love, or The Rambling Lady'; etc.

Southernwood, an ornamental and culinary herb. See ARTEMISIA.

South'esk, James Carnegie, 9th EARL OF, Scottish author: b. Edinburgh, Scotland, 16 Nov. 1827; d. 21 Feb. 1905. He was educated at Sandhurst, entered the army in 1845, and was lord-lieutenant of Kincardineshire in 1849-56. He published: 'Herminius, a Romance by J. C. S.' (1862); 'The Burial of Isis and other Poems' (1884); 'Suomiria, a Fantasy' (1899); etc.

Southey, south'i or suth'i, **Caroline Ann Bowles,** English poetess, daughter of Capt. Charles Bowles, a retired officer, and second wife of Robert Southey (q.v.), to whom she was married in 1839: b. Lymington, Hampshire, 6 Dec. 1786; d. there 20 July 1854. Owing to the death of her mother in 1816 and the loss of her property she was compelled to turn to literature for maintenance and in 1820 sent the manuscript of 'Ellen Fitzarthur' to Robert Southey for approval. This led to considerable correspondence between them and finally resulted in their marriage in 1839. Meanwhile she had written 'Tales of the Factories' (1823) in verse; 'Solitary Hours' (1826) in verse and prose; 'Chapters on Churchyards' (1829), prose tales which gained her wide reputation; 'Selwyn in Search of a Daughter' (1835); 'The Birthday' (1836); etc. She also collaborated with outhey on the poem 'Robin Hood,' which was not, however, completed. After Southey's death she lived in retirement. Her collected poems were published in 1867. For bibliography see SOUTHEY, ROBERT.

Southey, Robert, poet-laureate, historian, miscellaneous writer: b. Bristol, England, 12 Aug. 1774; d. Keswick, England, 21 March 1843. His father was Robert Southey, a linen draper; his mother was Margaret Hill, daughter of Edward Hill, gentleman, of Bedminster. Southey spent most of his boyhood in the care of his mother's half-sister, Miss Elizabeth Tyler of Bath. She gave him access to the theatre and to books, and, in his fourteenth year, she sent him to Westminster School. There he remained four years; then, for publishing in the school paper a protest against excessive flogging, he was privately expelled. His mother's brother, the Rev. Herbert Hill, sent Southey to Oxford. He matriculated at Balliol College, 3 Nov. 1792. In his regular studies he was but little interested; but he read much, and was especially influenced by the stoicism of Epictetus.

Southey's first important literary work, 'Joan of Arc,' an epic in twelve books, he composed during his summer vacation, 1793. He intended it as a tribute to the principles of the French Revolution; but the execution of the Girondins in October of that year cooled his enthusiasm. Then in June 1794, he found a new outlet for his ardor in the scheme of pantisocracy proposed to him by Samuel Taylor Coleridge. For lack of funds, their plan for a colony on the banks of the Susquehanna ultimately failed. Southey was glad to accept an invitation from his uncle, the Rev. Herbert Hill, to visit Lisbon. The intended emigration, however, had one permanent effect: Southey had engaged himself to Edith Fricker; Coleridge, to her sister Sara. Before Southey sailed for Lisbon, he married Edith, 14 Nov. 1795.

This marriage proved a great steadying influence on Southey's life. Returning from the Peninsula early in 1797, he made a serious attempt to study law, and, finding that he lacked ability in this, transferred his efforts to earning a livelihood with his pen. Within three years, beside much miscellaneous work, he published 'Minor Poems' (1797), completed 'Madoc,' and planned 'Thalaba' and a 'History of Portugal.' In 1800, illness drove him again to Portugal, where he gathered material for his 'History,' and completed 'Thalaba'. Recovered in health, he accepted a secretaryship to Isaac Corry, chancellor of the Irish exchequer, "a foolish office and a good salary" which he soon resigned. Back in England, he removed in 1803, from Bristol to Keswick. There Coleridge was established in "Greta Hall"; and of this house Southey—to enable his wife to be near her sister, Sara Coleridge—took one half. In 1809, he became owner of the entire house, and harbored with his own the family that Coleridge had deserted.

Here was Southey's home for life. Here were born all but the first of his seven children. Here he brought together his library of fourteen thousand volumes. Here he did his work: kept in hand the epics from which he hoped for fame; gathered materials for that great history of Portugal destined never to be written; ground out the translations, histories, biographies, and magazine articles, the glorified hack-work by which he met the growing needs of his own family and that of Coleridge. Pantisocracy, despite the pleadings of Coleridge, Southey had abandoned. But Southey had found a more practical idealism: he worked steadily and cheerfully; he met his business engagements punctually; he aided younger literary aspirants with money and advice; and, although no longer as

Digitized by Google

in youth a revolutionist, he championed in print more than one cause of progress and reform.

His work was not unrecognized. The *Quarterly Review*, to which, between 1808 and 1839, he contributed 95 articles, paid him during the latter part of that peroid, £100 for each. In 1813 he was made Poet Laureate. In 1820 Oxford conferred on him the degree of D.C.L. In 1826, without his knowledge, he was elected M. P. for Downton; and, when he protested that he lacked the property qualification, Sir Robert Inglis promptly proposed that an estate of £300 a year be purchased for him. Southey, averse to public life, declined this offer, as he did that of Sir Robert Peel, in 1835, to make him a baronet. Peel, however, found means to be of use to Southey, for, by a general act for the recognition of distinguished services to literature and science, he obtained for Southey a pension of £300.

The last years of Southey's life were sad. On 2 Oct. 1834, he wrote: "I have been parted from my wife by something worse than death. Forty years she has been the life of my life; and I have left her this day in a lunatic asylum." In the spring, they brought her back to Greta Hall. In the autumn she grew weaker. On 16 Nov. 1835, she "passed quietly 'from death unto life.'" Southey himself, still physically strong, was beginning to show mental weakness. In 1839, he married Caroline Bowles, the poetess, a friend of the Southeys for twenty years. Of his condition in 1840, Wordsworth wrote: "Southey did not recognize me till he was told. Then his eyes flashed for a moment with their former brightness, but he sank into the state in which I had found him, patting with both hands his books affectionately like a child." He died 21 March 1843.

Southey's literary work falls roughly into two groups: his poetry, for the most part early, before he was thirty; his prose, for the most part later. The first group consists chiefly of long narrative poems: 'Joan of Arc' (1796); 'Thalaba' (1801); 'Madoc' (1805); 'The Curse of Kehama' (1810); and 'Roderick, the Last of the Goths' (1814). Legendary or mythological in subject, these poems embody in an exotic setting—Gothic, Arabian, Hindoo, what-not—their author's high-souled ethical ideals. For their setting and their philosophy, these poems are worth reading; but they are lacking in vital relation to life. In lyric emotion, also, they are lacking: Southey's stoicism made such emotion unnatural; and he was too sincere to feign. Of the poems that he wrote as Laureate —'Carmen Triumphale' (1814), 'The Poet's Pilgrimage to Waterloo' (1816), the 'Ephithalamium,' and the 'Elegy for the Princess Charlotte' (1817), 'The Vision of Judgment' (1821), and 'A Tale of Paraguay' (1825)—the 'elegy' and the 'Tale' are the best. Southey's 'Poetical Works collected by himself' appeared, London, 10 vols., 1837-8.

His best work, however, was done in prose, notably in his 'Life of Nelson' (1813), and his 'Life of Wesley' (1820). His scholarly 'History of Brazil' (1810-1819) is unfortunate in its subject. His 'History of the Peninsular War' (1823-32) is defective in its grasp of military movement and has been superseded by that of Sir William Napier. Of his translations of mediæval romances, the best is his 'Chronicle of the Cid' (1808). Chief among his other prose works are: 'Omninia' (1812), 'The Doctor' (1834-7); 'Sir Thomas More, or Colloquies on the Progress and Prespects of Society' (1829); 'Life of Cowper' (1833-7); and 'Lives of the Admirals, or Naval History of England' (1833-40). And yet, among all his works, both prose and poetry, Southey will perhaps live longest by his nursery classic of 'The Three Bears' and by his verses 'After Blenheim.'

Southey was not a genius. He is not even to be classed with his friends, Wordsworth, Coleridge, and Scott. Byron wrote truly when he said that Southey

"..... had written much blank verse and blanker prose,
And more of both than anybody knows.."

But Southey was at least a faithful workman and a worthy man. As even Byron admitted, he was for his time "the only existing entire man of letters."

Bibliography.—The best brief biography is that by Edward Dowden in the 'English Men of Letters' series (1879). Consult also Southey's letters, edited in six volumes by Rev. C. C. Southey (1849-50); in four volumes by Rev. J. Wood Warter (1856); and in the single volume edited by John Dennis (1887).

ARTHUR H. NASON,
Instructor in English, New York University.

Southington, suth'ing-tŏn, Conn., town in Hartford County; on the New York, New Haven & Hartford railroad; about 25 miles north of New Haven and 18 miles south by west of Hartford. It is on a small stream which furnishes considerable water-power. The chief manufacturing establishments are hardware works, including carriage supplies. Other establishments produce cutlery, ceiling and floor plates, tinmen's supplies, and wood screws. In 1900 there were in Southington 65 manufacturing establishments, with a capital invested of $2,783,709; the number of employees, 1,415; the wages paid annually, $627,604; the cost of raw material, $797,102; and the value of the product, 1,994,564. The educational institutions are the Lewis high school, the public elementary schools, and a library. There is a savings bank and two national banks; the combined capital of the national banks is $100,000. Pop. (1890) 5,501; (1900) 5,890; (1910) 6,516.

South'port, England, in Lancashire, a fashionable seaside resort on the northwestern coast, about 18 miles by rail north of Liverpool. There is a fine beach as far as the latter town. The main street terminates in a public park, and the esplanade commands beautiful views of the Welsh Mountains. Attractive features are the Pavilion and Winter Gardens, which include an opera-house and concert-hall; marine drive and gardens; Cambridge Hall; Public Library and Art Gallery; Grecian town-hall; Victoria Baths, finest and largest in the kingdom; Victoria Schools of Art and Science; and hospital. There are numerous churches and about 200 schools; the museum stands in the fine botanic gardens.

South'well, Robert, English poet: b. Horsham, Norfolk, about 1561; d. Tyburn 21 Feb.

Digitized by Google

1595. He was educated at Douay and Paris under Jesuit influence, and was ordained to the priesthood in 1584. In 1586 he returned to England, but owing to the penal laws against Catholics and especially against priests, was obliged to live in the greatest seclusion. In 1589 he became domestic chaplain to the Countess of Arundel and composed various pieces in prose intended to give comfort and encouragement to his co-religionists in their trials. Chief among the objects of his solicitude was the Earl of Arundel, under sentence of death in the Tower. On 20 June 1592 Southwell was arrested for visiting the house of Richard Bellamy, a Catholic under suspicion. He was many times tortured in order to extort from him confessions that might be used in prosecuting other Catholics; but his only answer was that he was a Jesuit and was prepared to die. In February 1595 he was tried for treason under the statute that prohibited the presence in England of Jesuits or seminary priests. He was hanged, drawn and quartered at Tyburn. Shortly after his execution collections of his poems were published and many subsequent editions have appeared. A collected edition was edited by Walter in 1817 and by Turnbull in 1856. Of his verse the most notable examples are 'Saint Peter's Complaint' and the 'Burning Babe.' Of his English prose tracts 'Mary Magdalen's Teares' may be mentioned.

Southwest Africa, German, a German possession bordering on the Atlantic coast of South Africa, between the Kunene and the Orange rivers, a distance of nearly 950 miles. It is bounded on the north by Portuguese West Africa, on the south by Cape Colony, and it extends inward about 400 miles, being bounded on the east by British Bechuanaland. A narrow projection in the northeast runs more than half way across the continent to the Zambesi River. The small enclave of Walfish Bay in the middle of the west coast belongs to Great Britain. The area of the colony is 320,750 square miles. It occupies the territories otherwise known as Damaraland and Great Namaqualand. The land rises in broad, flat terraces, to the mountain range which bounds the vast South African plateau. The highest point is 8,793 feet above the sea. East of the range the land slopes into the Kalahari basin. In this vast region there are no permanent rivers, except the Great Fish River, which flows south through the mountains into the Orange. The greater part of the year is rainless, and the coast regions and southern portions are arid desert, the rest of the country being grass steppes, suitable in the north for grazing. The whole country is rich in copper, and there are large guano beds. Fruit and viticulture are being developed in the north. Commerce is increasing, the chief exports being guano, cattle products and ostrich feathers. The chief port is Swakopmund near Walfish Bay. A railroad connecting it with Windhoek in the interior was completed in 1902. In 1910 there were 4,000 white inhabitants in the colony. The natives number about 200,000, and belong chiefly to Haerero, Damara, and Hottentot tribes. The first German trading station was founded on the coast at Angra Pequena in 1883, and by 1886 a German protectorate had been established from the Orange to the Kunene. The natives were hostile, and subdued only after a long war. In 1904 they again rose in a formidable insurrection, and before the expeditionary column could relieve the exposed settlements, hundreds of white settlers had been slain with revolting barbarity.

Southwest Kansas College, located at Winfield, Kan. It was first opened to students in 1886, and is under the control of the Methodist Episcopal Church. It has preparatory and collegiate departments. The collegiate department offers three courses, the classical, philosophical, and scientific, which lead respectively to the degrees of A.B., Ph.B., and B.S. There are also courses in pedagogy and business. In 1904 the grounds and buildings were valued at over $60,000; the annual income amounted to $9,500. The library contained 3,000 volumes, the students numbered 300, and the faculty 15.

Southwest Territory, a territory of the United States, comprising all the region ceded by North Carolina (now Tennessee) and the narrow strip ceded by South Carolina. This was organized in 1790 as the Southwest Territory, with institutions resembling those of the Northwest, except for the admission of slavery. With the admission of Tennessee, in 1796, and the organization of the Mississippi Territory, in 1798, the Southwest Territory went out of existence.

Southwestern Baptist University, located at Jackson, Tenn. In 1847 the Baptists of Tennessee established an institution at Murfreesboro under the name of Union University; during the Civil War the building was damaged, the equipment destroyed and the endowment rendered worthless; these difficulties were partially overcome and the university continued its work until 1873 when it was further crippled by an epidemic of cholera in Murfreesboro, and all exercises suspended. In 1875 a new charter was obtained and the name Southwestern Baptist University adopted; since that time its prosperity has been continuous, and the endowment has largely increased. The organization of the University now consists of (1) the College Department; (2) the Department of Theology; (3) the Department of Law; (4) the Teachers' College; (5) the Business Department; (6) the Department of Oratory and Physical Development; (7) the Department of Music; (8) the School of Art; (9) the University Academy. The College Department offers two courses, leading to the degrees of A.B. and B.S., respectively; certain studies are required in each course, but the work is largely elective. There are also courses in electrical and civil engineering. The degree of A.M. is conferred for post-graduate work. The courses of the Theological Department do not lead to a theological degree, but are elective and are combined with the work of the A.B. and A.M. course. The Teachers' College, organized in 1902, offers four normal courses, including an advanced course in pedagogy; the Business Department offers two courses, accounting and stenography; the Department of Law confers the degree of LL.B. for a one year's course, the degree of LL.M. for a two years' course. The university is co-educational, and a dormitory for women was erected in 1897; a new chapel was completed in 1899. The library contains approximately 5,000 volumes; the students numbered 250, and the faculty 20.

Digitized by Google

Southwestern Louisiana Industrial Institute, a State secondary school for both sexes, located at Lafayette, La. It was chartered in 1898, and opened to students in 1901. The people of Lafayette parish offered to appropriate a tax of two mills on the dollar for ten years to the support of the institute; appropriations were also made by the State. The institute offers five regular courses, (1) the academic course of four years; (2) the manual training course, three years; (3) the domestic science course, three years; (4) the course in stenography and typewriting, two years; (5) the commercial course, one year. The academic course in the last two years is divided into two sub-courses, the Latin and the French; this course includes instruction in drawing and physical culture. The other four courses include a large proportion of academic studies, mathematics and English being required, and others mostly elective. The campus contains 25 acres; the buildings include the main building, the dormitory for girls, and the workshop. The students number 150, and the faculty 8.

Southwestern University, located at Georgetown, Texas; established by the five Texas Conferences of the Methodist Episcopal Church, South. The movement for the establishment of the university was begun in 1869, the first session was opened in 1873, and the charter obtained in 1875. The chartered rights of Ruterville College, Ruterville, McKenzie College, Clarksville, Wesleyan College, San Augustine, and Soule University, Chappell Hill, were transferred to Southwestern University by order of the Conferences and by special acts of the State legislature. Shortly after the establishment of the university, the need of college education for women in the South led to a movement which resulted in the organization of the Ladies' Annex. Originally the Annex was under the charge of the same faculty, but all classes were separate; exception was made in the case of scientific laboratory work. In 1900 the Annex was more closely affiliated with the university, and the women students of the Annex admitted to all college classes with men. The university has the following departments of instruction: (1) The College; (2) the School of Fine Arts; (3) the Fitting School. Separate classes for Annex students are organized in the School of Fine Arts and the Fitting School only. The College offers three courses, the A. B. course which must include the classical languages; the B. S. course, largely scientific; the Ph. B. course, combining classical and modern languages; Biblical literature is required in all. The work of the Freshman and Sophomore years is prescribed in each course, the work of the last two years fully half elective; the prescribed studies in the Ph. B. and B. S. courses depend upon the entrance studies offered. The degrees of A. M. and M. S. are conferred for graduate work. The School of Fine Arts offers instruction in art, elocution and music. The campus is in three tracts, the Fitting School campus, the Annex campus, and the College campus. Giddings Hall, a dormitory for men and five residence cottages are near the Fitting School; a new college building was completed in 1900 for scientific laboratories and the library. The students in 1911 numbered 488, and professors 36.

South'worth, Emma Dorothy Eliza Nevitte, American novelist: b. Washington, D. C., 26 Dec. 1819; d. there 30 June 1899. In 1840 she was married to Frederick H. Southworth of Utica, N. Y., was thrown upon her own resources two years later, and engaged in teaching in Washington in 1844–9. Her first story, 'The Irish Refugee,' appeared in the Baltimore 'Saturday Visitor,' and she subsequently wrote for the 'National Era' and the New York 'Ledger.' Her work is characterized by some dramatic power, and is still popular, with uncritical readers, having been republished abroad, and translated into several languages. She was a prolific writer and more than 60 novels were originally issued serially. A uniform edition of her works beginning with 'Retribution,' including 'The Hidden Hand,' which was successfully dramatized, and ending with 'The Fatal Secret,' was published in 42 volumes in 1872. Among her later works are: 'Unknown' (1874); 'Mother's Secret' (1883); 'An Exile's Bride' (1887); etc.

Southworth, Franklin Chester, American Unitarian clergyman: b. North Collins, N. Y., 15 Oct. 1863. He was graduated from Harvard in 1887, and from Harvard Divinity School in 1892, and for several years taught in various schools of New England. Entering the ministry he was pastor of the First Unitarian Church, Duluth, Minn., 1892–7, and the First Unitarian Church of Chicago in 1897–9. In 1902 he was appointed president of the Theological School of Meadville, Pa., and professor of practical theology there.

Souvestre, soo-vĕstr, **Emile,** French novelist and dramatist: b. Morlaix 15 April 1806; d. Paris 5 July 1854. His literary work was an issue aside from the business of his life, and he was successively clerk, schoolmaster, journalist and in 1848 professor of administrative style in a civil service school. His 'Un philosophe sous les toits' was crowned by the academy in 1851 and in the August following his death his widow received the Lambert prize founded in honor of the memory of the writer who had conferred the highest service. He was the author of 'Derniers Bretons' (1835–7), and 'Foyer Breton' (1844), works embodying the folk-lore and natural features of his native province; also 'Pierre et Jean' (1842); 'Confession d'un ouvrier' (1851), and other fictions; besides dramas, works of travel and biographies.

Sov'ereign. (1) In politics, the highest person in a state; applied also adjectively to the highest power in a state, or to a state which exercises supreme or independent authority. Thus the legislature in its various branches is the sovereign power in each state, though the name of sovereign in a limited monarchy is reserved for the monarch, and a state which owns no superior is termed a sovereign state. (2) a gold coin, the standard of the English coinage. It exchanges for 20 shillings sterling, or about $5.

Sow-bane. See GOOSEFOOT.

Sow-thistle, a genus (*Sonchus*) of herbs of the order *Compositæ*. The species, of which there are about 30, are natives of the Old World, but some have become widely naturalized in temperate climates. They have alternate leaves, blue or yellow flowers in heads and beaked seeds

Digitized by Google

crowned by fine white down. The common sow-thistle (*S. oleraceus*) is an annual which grows about 30 inches tall, has yellow flowers, and is found usually in rich soils. Its young leaves and tender tops are used as a substitute for spinach in northern Europe. The alpine sow-thistle (*S.* or *Lactuca, alpina*) is a native of mountainous Europe. It has beautiful blue flower-heads. The beach sow-thistle (*S. maritimus*) grows in saline soils in southern Europe, and is specially attractive because of its yellow flower-heads. These species are sometimes cultivated in gardens.

Sowens, sō'ĕnz, in Scotland, an article of food made from the farina remaining among the seeds (husks) of oats. The husks are steeped in water till the farinaceous matter is dissolved and the liquid has become sour. The whole is then put into a sieve, which allows the milky liquid to pass through into a barrel or other vessel, but retains the husks. The starchy matter gradually subsides to the bottom of the vessel. The sour liquid is then decanted off, and about an equal quantity of fresh water added. This mixture, when boiled, forms sowens.

Sower, or **Saur, Christopher,** German-American printer: b. Laasphe, near Marburg, Germany, 1693; d. Germantown, Pa., 25 Sept. 1758. After study of medicine at Halle, he came to Philadelphia in 1724, was for a time a farmer in Lancaster County, but in 1731 removed to Germantown, where he acted as an importer of German Bibles and religious works. In 1738 he obtained a printing-press and began the publication in German of a 24-page almanac, which continued to appear until 1798. He began in 1739 'Der Hoch-Deutsch Pennsylvanische Geschichtschreiber,' a religious and secular magazine, the first periodical in German in the United States. It was published at first quarterly at three shillings per annum, and afterward monthly. He established (1738) the first type-foundry in America, made his own ink for printing, and later manufactured his paper and did his binding. In 1743 he published in German a Bible of small quarto size, Luther's translation, the edition being limited to 1,200 copies of 1,284 pages. With the exception of Eliot's Indian Bible, this was the first Bible printed in the colonies, and its was the largest work that had then been attempted. An English Bible was not printed until 1781 by Robert Aitken at Philadelphia. Sower may have invented cast-iron stoves; he introduced them into general use. Consult: Thomas, 'History of Printing in America' (1870); Ringwalt, 'Encyclopædia of Printing' (1871).

Soy, a sauce prepared by the Chinese from the seeds of a sort of native bean. The process of preparing soy consists in boiling the seeds until they become soft, and mixing with them an equal weight of wheat or barley meal coarsely ground. This mixture is fermented, and a certain proportion of salt and water being added, the whole is allowed to stand for two or three months, care being taken to stir it daily; at the end of this time it is ready for use. The seeds are, besides, employed in China and Japan as food. In Japan they are put into soups, and are the most common dish of the country, being frequently eaten three times a day.

Soy Bean, a leguminous plant (*Glycine hispida*), sometimes incorrectly called soja bean, native to southeastern Asia. It has been cultivated from ancient times, and in some countries, notably Japan, it forms an important article of food. It was introduced into England in 1790, and into America some years later, where it was first grown principally in the southern States. Its use as a food for man has not become general except in its original home in Asia, and it it only within recent years that its value as a feed for stock has brought it to the attention of the western countries. The soy bean is an annual, 2 to 4 feet high. It has branching, hairy stems with trifoliate, hairy leaves. The flowers are inconspicuous, of pale lilac or violet color, and the fruit is a broad, 2 to 5-seeded pod, covered, like the rest of the plant, with stiff, reddish hairs. The seeds vary in color according to variety. When grown for the seed the crop sometimes yields as high as 40 bushels or more to the acre, but the average is much less. As a forage crop it makes as high as 2 to 3 tons of cured hay per acre. The fact that the flowers are self-pollinated gives it an advantage over many other legumes in introducing it into new regions. (Compare DOLICHOS.) Innumerable varieties and forms of the soy bean have been developed in the original home of the plant. Several different varieties have been introduced into the United States, these being distinguished largely according to the shape, size and color of the seed, in the degree of hairiness, and in the time required for the plants to reach maturity. The early varieties are preferred when the plant is grown for seed, while the later give better results as forage crops. Some of the advantages claimed for it as a crop are that it is able to gather the food of sustenance in relatively poor land, and by its power to assimilate nitrogen from the air to enrich the soil in which it grows. It is relatively sure of producing a crop of seeds very nutritious to live stock, for which it is adapted to use in various forms.

Soy beans require about the same conditions for growth as corn, but have somewhat better powers of resisting drought. The seed is not planted until the ground is thoroughly warm in the spring, and the earlier varieties are grown with fair results by planting after an early grain crop has been harvested. When planted for forage the seed is often sown broadcast, but where a crop of beans is desired it is better to plant in drills. The stage of growth at which to harvest depends upon the use to be made of the crop. In the United States the soy bean is grown exclusively as a feed for stock, in pasture, as a soiling crop, for hay, or as a green manuring crop. The green feed and hay are excellent for cows in milk. The beans are usually fed in the form of meal, and owing to the richness in protein and fats have been found of peculiar value in compounding feed rations. Fed in connection with less concentrated feeds and grains having a lower protein content, results have been obtained that show the soy beans to compare favorably in feeding value with cottonseed meal. The peanut is the only raw vegetable that contains as high a percentage of digestible protein and fat.

The soy bean is prepared for use as human food in a variety of ways in Japan, where it furnishes the protein that is lacking in a diet of

Digitized by Google

rice. The plant is also grown in Europe and used there to a limited extent as human food. Since the beans contain no starch they are sometimes recommended as food for persons suffering from diabetes; a soy-bean bread has been manufactured for this purpose. Under the name of coffee bean, the soy beans have been placed on the market in America as a substitute for coffee.

In the United States the soy bean is best adapted to the southern and central States. It is not adapted to the States along the northern border or to the States west of the Rocky Mountains. In those States where it thrives it is especially valuable to soils that have become depleted of their nitrogen. The chemical composition of both bean and fodder adapts it especially to use as a balance ration in connection with corn, and makes its cultivation desirable where no other protein feed is available.

Soyer, swä-yā, **Alexis Benoit,** French cook: b. Meaux 1809; d. England 5 Aug. 1858. Leaving Paris in 1830, he served the Duke of Cambridge, and became the chef of the Reform Club, 1837–50. In 1855 he went to the Crimea, reorganized the victualing of the hospitals, improved the food of the army and navy, and introduced cooking wagons. He was the most famous cook of his time and is immortalized as the Mirololant of Thackeray's 'Pendennis.' His writings on cookery were widely read, and include 'Culinary Relaxations' (1845); 'Charitable Cookery' (1847); 'History of Food in all Ages' (1853); 'The Shilling Cookery Book' (1854).

Soyeshima, Tanéomi, Japanese statesman: b. Saga, Province of Hizen. At Nagasaki in 1866 he studied under an American missionary, giving especial attention to the United States Constitution and the New Testament. In 1868 he became a commissioner for formulating laws and subsequently an imperial councillor. In 1871 he was sent to Siberia to adjust boundary questions relating to the island of Sakhalin. Returning to Japan he resigned his place in the cabinet, but was later asked to return to it. On a visit to China in 1876 he was received with high honors by the mandarins by reason of his scholarship, and he became private adviser of the emperor.

Spa, spä or spâ, Belgium, in the province of Liège, 21 miles south of the town of that name, a fashionable watering place, picturesquely situated, in an undulating country covered by woods, and containing wonderful medicinal springs. There are delightful promenades in the environs. The casino, bath-house, public squares and hotels are interesting features, besides a new parish church and the Gallery Leopold II., with its museum, music-halls, reading-rooms, etc. Gambling was prohibited in 1902. The town is renowned for its lacquer ware. There are tanneries, forges and foundries. Spa was early famous as a resort and frequented by Russian and Swedish potentates and all the fashionable world. The generic term for mineral baths was thus derived. The waters are exported to the most distant countries, and are efficacious in nervous diseases, anæmic troubles, dyspepsia and general debility.

Space, extension absolute or independent of anything it may contain. Whence the idea of space is derived is a question upon which schools of philosophy have ever been divided between two principal views, one that the idea of space is original and intuitive; the other that the notion of space arises from our experience of the material world, like our ideas of heat, color, sound, etc. The supporters of the intuitional origin of the idea admit that it does not arise in the mind until actual objects or extended things are presented to the senses; but they hold that this contact with the sensible world is, not the cause, but the occasion of our becoming conscious of what was already in the mind. Hence, for the intuitionists, the idea of space is not *innate;* but it is the innate element of the ideas of sense which experience calls into consciousness. If the idea of space were got solely from experience it would not possess the attributes of universality and necessity which are inherent in them: whatever is got by experience can be thought away; but space cannot. Those who hold the opposite view maintain that space is an abstraction from our experience of extended things, just as gravity is an abstraction from gravitating bodies. From experience we obtain various impressions, in the concrete, of things possessing extension; from these impressions we gain a notion of extension in the abstract, or space. Two questions arise in relation to the material universe, whichever view of the origin of the idea of space we adopt: first, is the material world finite or infinite? and secondly, how is universal space occupied? The answer to the first question is, that science has not discovered any limit to the extension of the material universe. With the improvement of the instruments of research the argument for an inconceivably great extension of the material universe has become constantly stronger, so that what appear mere specks on the field even of instrumental vision may be conjectured to expand into new spheres as vast as all that we can take in from our present point of view, and these again may be bounded by regions equally extended: and so *in infinitum.* But we have no means, either by actual information or by analogy, of forming any opinion as to the absolute infinitude of the cosmos. The other question, as to the occupation of space by material things, turns upon the continuity or non-continuity of the ultimate particles of matter. The distinct material forms that are directly cognizable by our senses — the solids, fluids and gases that we see, feel, taste, smell — are known to be composed of particles that are kept by certain forces apart from each other. But there are material forces — light, heat, electricity, etc. — which either are regulative of the atomic structure of matter, or are in other ways related to it, which imply the existence of material media too delicate to come directly within the cognizance of our senses. These forces are forces of motion; and as heat and light are known to travel through vast spaces which contain no atmosphere or other sensible form of matter, these spaces are supposed to be filled with an ether or subtle fluid, by the vibrations of which this motion is communicated.

Space of Dimensions. See Hyper Spaces, Geometry of.

Spada, spä'dä, **Lionello,** Italian painter: b. Bologna 1576; d. Parma 1622. He became the pupil of Caravaggio, with whom he traveled.

Digitized by Google

On his master's death he returned to Bologna, and spent his latter days at the court of the Duke of Parma. Among his works (which are well known in European galleries) 'Saint Dominic Burning the Heretical Books,' and an altarpiece in the church of Saint Domenico at Bologna, are considered his best.

Spade-foot Toad, a toad (*Scaphiopus holbrookii*) resembling the common toad in general appearance but differing from it so greatly in structure as to be placed in a distinct family (*Scaphiopidæ*). They have teeth on both the upper jaw and the vomer bone; the bodies of the vertebræ are cupped in front; the sternum is altogether cartilaginous; the sacral transverse processes are greatly expanded; the pupil of the eye vertical and the side of the foot is provided with a plate-like appendage supported by cartilage, from which they take their name. The spade-foot is found throughout the eastern United States, but is in most places rare and of very uncertain occurrence, appearing suddenly in great numbers and as suddenly disappearing some seasons, and again being entirely absent. It lives in burrows, from which it issues at night or after long-continued rains to feed on insects. Early in the spring it breeds, the eggs being deposited in temporary rain-pools. If the season be a dry one, development of the tadpoles is much quickened by the drying up of the water, but in wet seasons the larval period is extended. Most remarkable is the voice, which is so loud as to astonish all who hear it produced from so small an animal. These toads are very noisy during the period of reproduction, but soon after become quiet and disappear. Another species (*S. couchii*) is found in Texas and Mexico, and five or six more in the latter country.

Spade Guinea, an English guinea having a spade-shaped shield bearing the arms on the reverse. They were coined from 1787 to 1799 inclusive.

Spaeth, späth **(Phillip Friedrich) Adolph (Theodor),** American Lutheran clergyman: b. Esslingen, Würtemberg, 29 Oct. 1839; d. 2 June 1910. He was graduated from the University of Tübingen 1861; was called to Zion's Church, Philadelphia, Pa., in 1864, and was pastor of Saint Johannes German Lutheran Church, Philadelphia, 1867–1910. He was also a professor in the Lutheran Theological Seminary and was president of the general council of the Evangelical Lutheran Church in North America 1880–90. His publications include 'Phœbe, the Deaconess' (1885); 'Faith and Life as represented by Martin Luther' (1887); 'Biography of Dr. Charles Porterfield Krauth' (1898).

Spaghetti, spa-gĕt'tĭ. See MACARONI.

Spagna, spän'yä, **Lo,** or **Lo Spagnuola,** easel name of Giovanni di Pietro, Italian painter of the 16th century. He was a pupil of Pietro Perugino, whose name is frequently applied to Spagna's work. Very little is known of his life. He lived in Spoleto in 1516. His masterpiece 'The Madonna Enthroned' was painted in 1516. The National Gallery in London contains his 'Agony in the Garden,' which was formerly attributed to Raphael.

Spagnoletto, spän-yō-lĕt'tō, **Lo.** See RIBERA JOSÉ.

Spahis, spä'hĭs, or **Sipahis,** a part of the Turkish cavalry, which is said to have been organized by Amurath I., the founder of the janizaries; but which, since the organization of the Turkish army on the European system has given place to regular cavalry. The spahis were composed of two classes: one with red, the other with yellow banners. The usual arms of the spahis were a sabre, a lance, a jereed (a dart about 2 feet long, which was hurled with great strength and skill), and a second sabre, or rather broad-sword, attached to the saddle. Some of them had bows and arrows, and also pistols and carbines; but they made little use of fire-arms. The French call a body of light cavalry raised in Algeria by the name of spahis. The name sepoys given to native troops in India by the British, is the same word.

Spahr, spär, **Charles Barzillai,** American publicist and editor: b. Columbus, Ohio, 20 July 1860. He was graduated at Amherst, 1881, and studied later at Leipsic. He was associate editor of 'The Outlook,' 1886–1903, and since February 1904 has been managing editor of 'Current Literature.' He has published several articles on economic topics and is the author of 'The Present Distribution of Wealth' (1896); and 'America's Working People' (1900).

Spain, or **España,** a southwestern kingdom of Europe, outside Portugal (q.v.), embracing the larger part of the Iberian or Spanish Peninsula and lying between lat. 36° and 43° 46′ N.; lon. 9° 10′ and 3° 15′ E. It is connected with the Continent on the northeast by the chain of the Pyrenees separating it from France; and is bounded east and south by the Mediterranean Sea, west by Portugal and the Atlantic Ocean, and northwest by the Bay of Biscay. Measured diagonally, the greatest length is from Cape Creux, in the northeast, to Cadiz in the southwest, 656 miles; greatest breadth, from Cape Ortegal in the northwest to Cape Palos in the southeast, 583 miles; but measured due north and south and due east and west the greatest length is from Cape Penas to Tarifa, 540 miles; and the greatest breadth from Cape Creux to Cape Hombre, Vigo Bay, 620 miles. European Spain includes also the Balearic Islands in the Mediterranean, and the Canary Islands in the Atlantic. Of her former extensive possessions in Asia, Africa, America, and Polynesia, Spain retains almost nothing. Cuba and Porto Rico, two of the most valuable islands in the West Indies, were lost by her as a result of the Spanish-American War of 1898. The Philippine Islands off the coast of Asia were also ceded to the United States on the conclusion of the war. About the same time Guam, one of the Ladrones, was transferred to the United States, and soon afterward the other islands of the group, together with the Carolines, were sold to Germany. She still possesses some territory in north and northwest Africa, besides the islands of Fernando Po, Ternabon, etc., off the west African coast. The following table gives the area and population of the whole kingdom, showing the ancient kingdoms and provinces, and the modern provinces into which they were divided:

Digitized by Google

Ancient Kingdoms and Provinces	Modern Provinces	Area in square miles	Population in 1900
New Castile	Madrid	2,997	775,034
	Toledo	5,586	376,814
	Guadalajara	4,870	200,186
	Cuenca	6,725	249,696
	Ciudad-Real	7,840	321,580
Old Castile	Burgos	5,650	338,828
	Logroño	1,945	189,376
	Santander	2,113	276,003
	Soria	3,836	150,462
	Segovia	2,714	159,243
	Avila	2,981	200,457
	Palencia	3,126	192,473
	Valladolid	3,043	278,561
Leon	Leon	6,167	386,083
	Zamora	4,135	275,545
	Salamanca	4,940	320,765
Asturias	Oviedo	4,091	627,069
Galicia	Coruña	3,079	653,556
	Lugo	3,787	465,386
	Orense	2,739	404,311
	Pontevedra	1,739	457,262
Estremadura	Badajos	8,687	520,246
	Caceres	8,013	362,164
Andalusia	Seville	5,295	555,256
	Cadiz	2,809	452,659
	Huelva	4,122	260,880
	Cordova	5,190	455,859
	Jaën	5,184	474,490
	Granada	4,937	492,460
	Almeria	3,302	359,013
	Malaga	2,824	511,989
Aragon	Saragossa	6,607	421,843
	Huesca	5,878	244,867
	Teruel	5,491	246,001
Murcia	Murcia	4,478	577,987
	Albacete	5,972	237,877
Valencia	Valencia	4,352	806,556
	Alicante	2,098	470,149
	Castellon	2,446	310,828
Catalonia	Barcelona	2,985	1,054,541
	Tarragona	2,451	337,964
	Lerida	4,775	274,590
	Gerona	2,272	299,287
Navarre	Navarre	4,055	307,669
Basque Provinces	Biscay	849	311,361
	Guipuzcoa	728	195,850
	Alava	1,205	96,385
Islands	Balearic	1,860	311,649
	Canaries	2,808	358,564
	Total	197,766	18,607,674
African Possessions		243,890	147,000
Grand total		441,656	18,754,674

Besides Madrid, the capital, pop. (1900) 539,835, the principal towns of over 50,000 inhabitants are: Barcelona, 533,000; Valencia, 213,530; Seville, 148,315; Malaga, 130,109; Murcia, 111,539; Carthagena, 99,871; Saragossa, 99,118; Bilbao, 83,306; Granada, 75,900; Lorca, 69,836; Cadiz, 69,382; Valladolid, 68,789; Palma, 63,937; Xeres, 63,473; Cordoba, 58,275; Satander, 54,694, and Alicante, 50,142.

Topography.— The coast line is comparatively regular with gentle curves, presenting few remarkable headlands or indentations. The interior is much diversified, but its characteristic feature is its centre table-land, which occupies more than a half of the whole surface, and is from 2,000 to 3,000 feet above sea-level. It is nearly surrounded by mountains; north by those of the Asturias, a continuation of the Pyrenees, west by a branch of the same mountains stretching southward through Galicia, and along the frontiers of Portugal to the banks of the Douro, and thence continued through the south of Leon and Estremadura by a series of cordilleras, which finally become linked with a branch of the Sierra Morena; south by the Sierra Morena; southeast and east by the mountains of Murcia and Aragon, among which the sierras Albaracin and Molina are the most conspicuous; and northeast by a range which, commencing in the Sierra Moncayo, stretches northwest through Old Castile, and there forms the southern boundary of the basin of the Ebro. The table-land itself is traversed throughout its whole breadth, east to west, by two mountain ranges. The loftier of the two, the Sierra de Guadarrama, divides the table-land into two distinct portions; a northern comprehending the kingdoms of Old Castile and Leon, and covering an area of about 44,000 square miles, and a southern comprehending the kingdoms of New Castile and Estremadura, and covering an area of about 48,000 square miles. The second great range of the table-land lies wholly within the latter, and commencing in the Sierra Albaracin, on the confines of Aragon, stretches under various names, among which those of the sierras of Guadalupe, Toledo, and Mamez, are most conspicuous, nearly across the centres of New Castile and Estremadura, till it is met by the Sierra Alpedrena from Portugal. Besides these mountain ranges which thus bound or traverse the table-land, there is the magnificent chain of the Pyrenees, which, though partly belonging to France, presents its boldest front to Spain, and has its loftiest summits within it; and the Sierra Nevada, which with its ramifications, covers the greater part of the south of Andalusia.

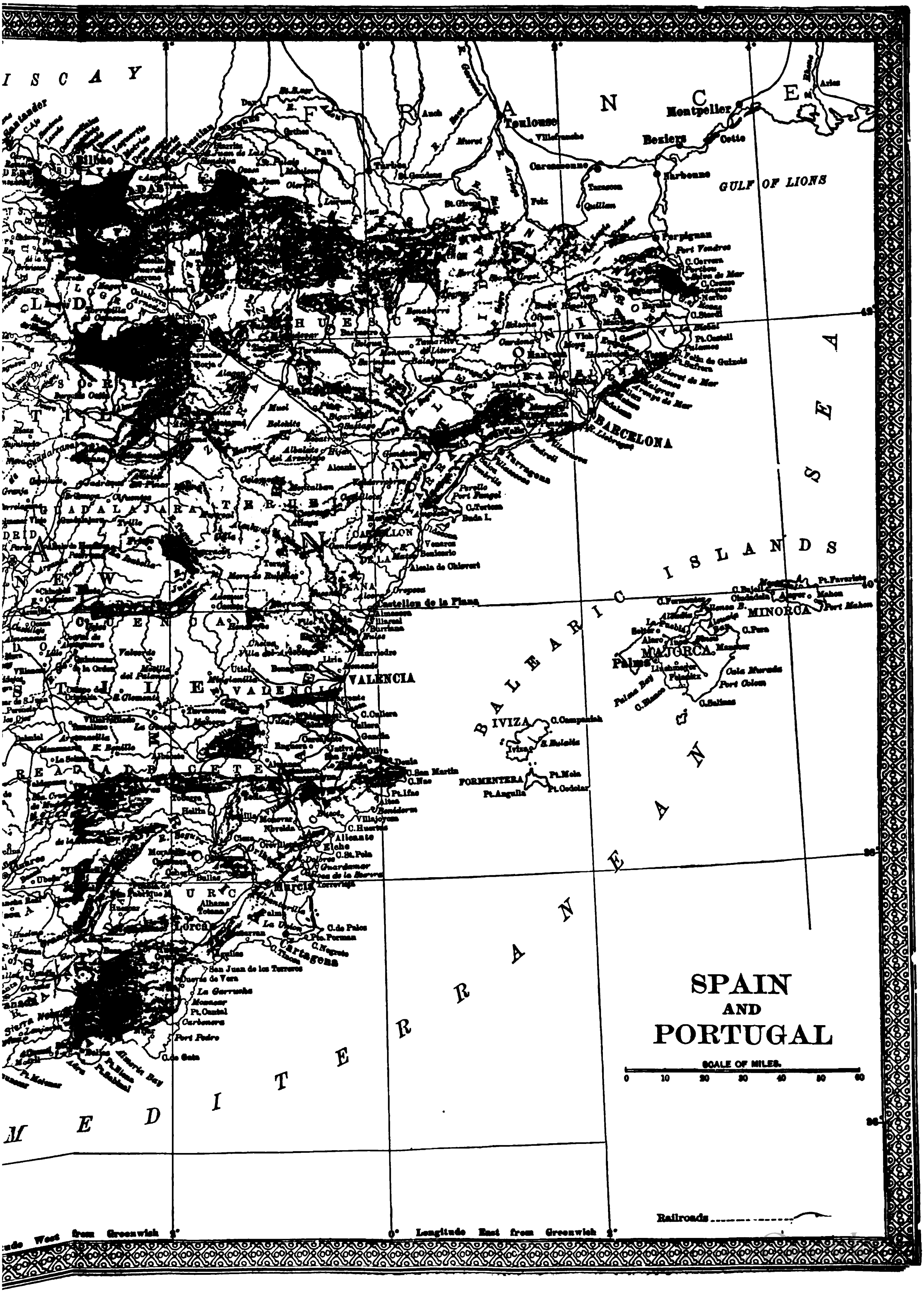
Hydrography.— The rivers are numerous. Their general direction is that of the great mountain ranges, flowing either eastward or westward. Those which flow eastward belong to the basin of the Mediterranean, and those which flow west to that of the Atlantic. The most important rivers of the former basin are the Ebro, the Segura, which rises in the most western part of Murcia, in the sierra of same miles, and has an easterly course of at least 200 miles; the Jucar, which, rising between the sierras Molina and Albaracin, flows for the most part through a wide and fertile valley, upward of 200 miles; and the Guadalaviar, which has a course of about 150 miles. The most important rivers of the latter basin are the Douro and Tagus, which, however, are more Portuguese than Spanish rivers; the Minho and Guadiana, also partly shared by Portugal; and the Guadalquivir. Considering the number and height of the mountain ranges, it is remarkable that Spain does not possess a single mountain lake deserving of notice. Its only expanses of standing-water are the lagoons which line part of its southern and western coasts, and are not only devoid of beauty, but often poison the air with pestilential vapors.

Geology and Mineral Resources.— Almost all the mountain ranges have a nucleus of granite, overlain by crystalline schists. This is particularly the case in the Pyrenees, the mountains which separate the two Castiles, and the basins of the Douro and Tagus, the Sierra Morena, and the Sierra Nevada. In the last the granite and schists often give place to immense masses of serpentine. The mountains of Asturias consist almost entirely of Carboniferous limestone and sandstone; and the same formation is largely developed in the Sierra de Gador, and in the deep valleys of the Alpujarras, Secondary rocks, still higher in the series, consisting of chalk and the accompanying strata, often overlie those of the Carboniferous limestone, and have their largest development in the districts which border the

Digitized by Google

Digitized by Google


BAY OF BIS
ATLANTIC OCEAN
GALICIA
CORUNA
LUGO
ASTURIAS
OVIEDO
SANTANDER
LEON
ORENSE
PONTEVEDRA
ZAMORA
VALLADOLID
PALENCIA
SEGOVIA
AVILA
SALAMANCA
MADRID
TOLEDO
CACERES
BADAJOZ
ESTREMADURA
CIUDAD REAL
CORDOVA
SEVILLA
HUELVA
CADIZ
MALAGA
ANDALUSIA
PORTUGAL
TRAS OS MONTES
BEIRA
ALEMTEJO
ALGARVE
Oporto
LISBON
Coruna
Santander
Gijon
Valladolid
Salamanca
Cordova
Sevilla
Cadiz
San Fernando
Malaga
Granada
Gibraltar
Strait of Gibraltar
Bay of Setubal
Tangier
Tetuan
AFRICA
Longitude West
MADRID
And Vicinity.


SPAIN
AND
PORTUGAL
SCALE OF MILES.
0 10 20 30 40 50 60
Railroads
GULF OF LIONS
BALEARIC ISLANDS
MEDITERRANEAN SEA
MINORCA
MAJORCA
IVIZA
FORMENTERA
BARCELONA
VALENCIA
Montpelier
Toulouse
Beziers
Cette
Narbonne
Carcassonne
Perpignan
Port Vendres
Castellon de la Plana
Cartagena
Murcia
Palma
Mahon
Port Mahon
C. de Gata
Almeria Bay
Longitude West from Greenwich
Longitude East from Greenwich

Digitized by Google

east coast. They also form great part of the ridges which intervene between the plain of La Mancha and the Mediterranean. Tertiary formations are found partly on the higher table-land in Old Castile, where they consist chiefly of marls and gypsum, and partly on the plains of Valencia, Alicante, Murcia, Carthagena, Aguilar, and Granada. They also fill several valleys, among others, those of the Segura, Lorca, Lower Ebro, and Guadalquivir. The whole country abounds with mineral wealth, the minerals including in greater or less quantities gold, silver, quicksilver, lead, copper, iron, zinc, calamine, antimony, tin, coal, etc. In the north (Asturias and Galicia) there are inexhaustible masses of iron ore. This ore is largely imported into Britain, and being very free from phosphorus and sulphur, is excellently adapted to the Bessemer process. Iron is also abundant in the Basque provinces. On the north coast there are important zinc mines. Lead is found in great abundance in the form of galena, the principal centres of production being Linares, Cartagena, and Almeria. About 100,000 tons of pig-lead are annually produced. In the province of Huelva, in the south of Spain, are immense deposits of iron pyrites, owned principally by English companies. The principal mines are the Rio Tinto and the Tharsis, the latter exporting annually 250,000 tons of pyrites. The ore contains 47 per cent of sulphur and 1¾ to 2½ per cent of copper, both of which are extracted to profit in Great Britain. Coal exists in various districts, but is chiefly obtained in the Asturias and Leon. The crown formerly possessed valuable mineral deposits, but has alienated the most of them except the quicksilver mines of Almaden.

Climate.— This, owing to the physical configuration of the surface, varies much in different localities. On the elevated table-land it is both colder in winter and hotter in summer than usual under the same latitude. In Madrid, which is situated upon it, the mean temperature of winter is about 47°, of spring 65°, of summer 86°, and of autumn about 66°. In the hottest month the mean temperature sometimes rises above 89°, and in the coldest falls below 40°. The mean annual temperature is between 65° and 66°. On the table-land, in summer, the sky is generally clear and cloudless, and rain seldom falls, but in winter it both rains and snows frequently. On the north coast the climate is damp, and injury is often suffered from a superabundance of moisture. In the northwest, in Galicia, a piercing wind, which the Castilians call *gallego,* often blows. In these quarters, in severe and rainy winters, the cold is occasionally extreme, and the olive and other southern fruits cannot be successfully grown. In the southeast districts, particularly in Murcia and Valencia, a kind of perpetual spring prevails; on the contrary, in the south and southwest, in Granada, and other parts of Andalusia, the climate is almost African, and a wind called *solano,* which withers up vegetation and enervates the animal frame, often blows for two weeks in succession. In the west the climate is mild but variable, the summer, however, is often very hot. Snow is confined chiefly to the more mountainous districts.

Forestry, Flora, Fauna and Fisheries.— The mountains and many tracts of the table-land are in general very scantily supplied with trees, and a want of timber, both for fuel and economical purposes, is severely felt in many quarters. The finest forests are on the western offsets of the Pyrenees and in the mountains of Asturias. The more remarkable trees are the Spanish chestnut and several varieties of oak, and in particular the cork-oak. The flora of Spain is unrivaled by any other European country in the wealth of its species. The species of phœnogamous plants number over 5,000. The endemic species is exceptionally numerous; the monotypic genera of Spain is the most prolific of the Mediterranean region. (Consult Willkomm and Lange, 'Prodromus Floræ Hispanicæ,' 1880.) The zoology of Spain includes a vast number of species. Of these, however, the only large animals in a wild state are the wolf, common in all the mountainous districts, and the bear and chamois, found chiefly in the Pyrenees. In Biscay the marten is frequently met with, and lynxes, foxes, wildcats, weasels, etc., are numerous in many quarters. The chameleon is found in the vicinity of Cadiz, and monkeys haunt the rock of Gibraltar. The feathered tribes are very numerous, particularly on the coast and at the mouths of rivers; eagles and vultures are common in some localities, and among interesting birds may be mentioned the flamingo, which is abundant in certain marshy regions of the south, and also breeds there. The number of rivers and great extent of sea-coast give great scope to the fisherman; and some important fisheries are carried on, particularly those of sardines in the north, and of tunnies and anchovies in the south.

Agriculture.— It is remarkable that Spain, though one of the most naturally productive, is also one of the least cultivated of the countries of Europe. More than a third of the land capable of profitable cultivation is allowed to lie waste, and the system of agriculture pursued is far behind that of any other European country. The finest agricultural district is Valencia, where both rice and corn are grown far beyond the wants of the actual population, and furnish large supplies to those parts of the interior which are less favorably situated. After Valencia, Catalonia, Murcia, and some of the northern provinces, raise the largest quantities of grain. The more important crops are wheat, rice, maize, barley, and legumes. The culture of the vine is general, and great quantities of wine are made, both for home consumption and exportation. The demand for the latter is chiefly confined to sherry and the sweet wines of Malaga and Alicante. A considerable part of the grapes grown are dried and exported in this state, especially from the port of Malaga. Nuts, common and pistachio, walnuts, and chestnuts grow in such abundance as to form important articles of trade. In the warmer districts the olive, sugarcane, and cotton-plant are partially cultivated. Fruits are extremely abundant, and include, in addition to apples, pears, cherries, plums, peaches, and apricots, the almond, date, fig, orange, citron, and pomegranate; and in the lower districts of the south, the pineapple and banana. Hemp and flax are extensively grown in Aragon and Galicia, and esparto grows in abundance, more especially in Valencia and Murcia, where it is in extensive demand for making ropes, mats, baskets, etc., besides being exported. The mulberry thrives well, and is largely cultivated for rearing silkworms in Valencia, Murcia, and Granada. Other vegetable products are saffron,

Digitized by Google

licorice, and barilla. Much of the higher part of the central table-land, however, presents a very sterile appearance, having a thin stony soil and a covering of heath and scanty pasture; still extensive tracts which might be advantageously cultivated are left almost in a state of nature, to be roamed over by cattle, sheep, goats, and swine.

Stock Raising.— Among domestic animals the horse, descended from breeds which the Moors had introduced, was long celebrated throughout Europe, but has in recent times declined in reputation, though Andalusia still boasts of many fine animals. The mule is generally preferred to the horse, both for carriage and draft, and is extensively reared in New Castile. Both it and the ass are generally of a very superior description. Horned cattle are generally inferior and not numerous; only in a few districts are cows kept for dairy purposes; bulls, in great demand for the national amusement of bull-fights, are reared in greatest perfection in Andalusia. The favorite stock is the sheep, a considerable proportion of which belongs to the celebrated Merino breed, to which almost all the other breeds of Europe are more or less indebted for improvement. Goats also are very numerous, and in their flesh, milk, and cheese furnish the favorite food of the inhabitants. Swine are kept in large herds in some parts of Estremadura and in some of the northern provinces, where they roam at large in the forests.

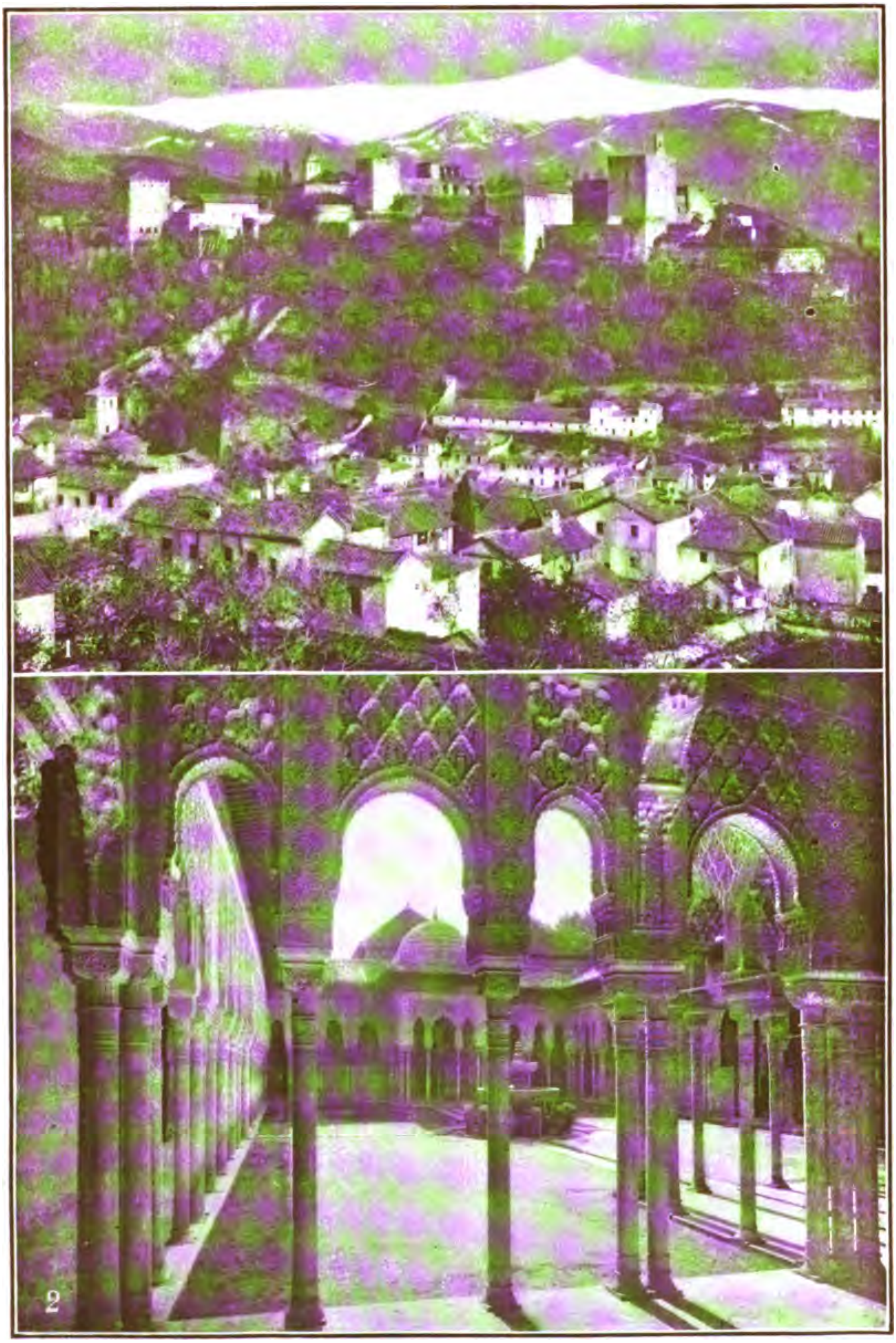
Manufactures and Commerce.— In the Middle Ages the manufactures of Spain, particularly along the coasts of the Mediterranean, were in a flourishing condition, and found an extensive demand, particularly in the Levant and other parts of the East. With the expulsion of the Moors the branches which they had specially fostered sunk rapidly into decay, and have never been revived. New demands, however, arose in the West, and Spain, as the mother country, reserving to herself the sole supply of the colonies, was able, for that purpose alone, to carry on a number of lucrative manufactures. The loss of these colonies, putting a sudden stop to the demand, was followed by their almost as sudden extinction. The circumstances of the country since have been the most unfavorable that can be conceived to the progress of any branch of regular industry, and hence the only manufactures of any importance are to be found in a few of the larger towns, especially Barcelona. The chief articles of export are wine, fruits, lead, iron ore, copper ore, oils, cottons, cattle, cork, wool, and agricultural produce. In the year 1900 the total imports were of the value of $172,500,000, the exports of the value of $145,000,000. Among the countries sending goods to Spain, Great Britain occupies the chief place, France, the United States, and Germany coming next in order.

Communications and Shipping.— Trade labors under great disadvantages from the want of proper means of communication. The roads, except the royal roads (*caminos reales*), are generally wretched; the rivers, though numerous, are ill fitted for navigation; and though in recent times much has been done in constructing railways and tramways, much more is still required. Hence the foreign trade is almost necessarily confined to such articles of raw produce as are raised in greatest abundance and can be most easily conveyed to a seaport. The length of railways in Spain is over 8,300 miles, all privately owned. The merchant marine in 1900 consisted of 1,142 vessels (each of 100 tons at least), total tonnage, 541,964 tons; 449 vessels of 430,996 tons burden being steamers.

Money, Weights, and Measures.— By a decree of the Cortes in 1868 a new monetary system was introduced into Spain, according to which accounts are kept in *centimos* and *pesetas:* 100 centimos = 1 peseta = 9½*d.* sterling, or one franc. The gold coins are pieces of 100, 50, 25, 20, 10, and 5 pesetas; the silver coins are pieces of 5, 2, 1 pesetas, and 25 and 20 centimos. The bronze coins are pieces of 10, 5, 2, and 1 centimos. The weights and measures are precisely the same as those of France, with no other change than a slight one of names, the *metre* becoming the *metro,* the *litre* the *litro,* and so on.

Government.— Up to 1868 the government of Spain, which was that of a hereditary constitutional monarchy, was regulated by a constitution adopted in 1837, and subsequently modified in 1845. After the deposition of Isabella II. a new constitution was drawn up by the Cortes, elected by universal suffrage. This constitution bore date 1 June 1869, and modified considerably the previous one. According to it, "all powers emanate from the nation. The power to make laws resides in the Cortes. The sovereign sanctions and promulgates the laws. The executive power resides in the sovereign, who exercises it by means of ministers. The tribunals exercise the judicial power." After the abdication of King Amadeo in February 1873, Spain changed its form of government to that of a federative republic, until the proclamation, as king, of Alfonso XII., 31 Dec. 1874, when the constitution of 1869 was again brought into force. A new constitution, however, was proclaimed in 1876, when certain amendments were introduced. According to the enactments at present in force Spain is governed constitutionally, the executive power residing in the king, the legislative in the king and Cortes (or parliament) conjointly. The Cortes consists of two independent bodies, or bodies of equal authority, the Senate and the Congress. The members of the Senate form three classes, namely, senators in their own right, not to exceed 80 in number; life senators nominated by the crown, 100 in number; and elected senators, 180 in number. The senators in their own right include royal princes who have attained their majority; grandees of the kingdom who are in possession of an income of 60,000 pesetas, or about $12,000; captains-general in the army, admirals of the navy; the archbishops, the patriarch of the Indies, the presidents of the council of state, the supreme tribunal, and several other similar functionaries. The elective senators are chosen by the corporations of state, such as provincial legislatures, universities, the ecclesiastical bodies, etc., and the citizens who are the largest payers of state burdens, and this portion of the Senate is renewed by one half every five years, or altogether when the body is dissolved by the sovereign. The Congress, or second legislative body, is to comprise at least one deputy to each 50,000 of the population. The Cortes must meet each year, and its sessions are to be convoked, suspended, or closed by the king. No project can become law until after it has been voted in

Digitized by Google



1. View of the Alhambra and Sierra Nevada Mountains.
2. Court of Lions, Alhambra.

Digitized by Google

Digitized by Google

both bodies. Projects of finance or taxation must be presented to the Congress before being submitted to the Senate.

Finances.— The revenue, raised chiefly by direct and indirect taxation, stamp-duties, government monopolies, colonial revenue, and income from state property, amounted, according to the budget of 1901–2, to $195,000,000, the expenditure being somewhat less. The public debt, consolidated and floating, amounts to over $1,930,000,000, with an annual interest of nearly $80,000,000.

Army and Navy.— The army has been reorganized after the model of that of France. The military forces consist of three bodies — a permanent army, an active reserve, and a sedentary reserve. The permanent army consists of a force which may be annually fixed by the Cortes. All Spaniards above the age of 19 are liable to be drawn for the permanent army, in which they have to serve three years. The active reserve is composed of all young men who, without reckoning three years of active service, shall have exceeded the number of years fixed by law for the permanent force. The position of these men is that of soldiers upon six months' furlough without pay. The sedentary reserve consists of all those men who, proceeding from the recruits, shall have had three years' effective service. The term of service in the sedentary reserve is six years. Exemption from service may be purchased for $300. According to a law of 1870, modified by laws in 1877, 1878, 1882, and 1885, the army is recruited by the method of conscription. The kingdom is divided into eight army-corps districts, with headquarters at Madrid, Seville, Valencia, Barcelona, Saragossa, Burgos, Valladolid, and Corunna. The strength of the permanent army for 1900 was returned at 117,774 in peace and over 1,000,000 in war. The naval force consists of about 14,000 sailors, with about 9,000 marines. The navy was almost totally destroyed or captured in the war with the United States, but efforts are being made to recover Spain's position in this respect. At present she has only one battleship, and that of the second class, and very few cruisers, coast-defense vessels, etc.

Ethnology.— The inhabitants of Spain consist chiefly of Spaniards proper, composed of a mixture of ancient aborigines, Romans, Visigoths, Vandals, and Suevi; but partly also of three other distinct races — Basques, occupying the provinces to which they give their name, and forming about one twenty-fourth of the whole population; Moors who, in the general expulsion of their countrymen, found refuge in several valleys in the kingdom of Granada and the Castiles, and whose descendants, unmingled with the other inhabitants, are still living there to the number of about 60,000; and Gitanos, or gypsies, who are found diffused over all parts of the Peninsula. The Spaniards proper, to whom only it is necessary here to advert, are of middle stature, well formed, of a sallow hue, sharp features, dark hair, and keen black eyes. In diet the Spaniards are frugal and temperate. Their wants being thus comparatively few, are easily satisfied, and furnish no strong stimulus to exertion. Indolence accordingly is a prevailing vice, and the highest ambition generally felt is to be able to live without doing anything. In their intercourse with strangers they are reserved, taciturn, and stand much upon their dignity, afraid apparently of its being encroached upon by undue familiarity; but on finding what they conceive to be their true place properly recognized, they lay aside their restraint, form strong attachments, and become the most agreeable of companions. With their natural indolence there is a strange mixture of enthusiasm, and when their passions are once roused there are few extravagances or excesses of which they are not capable. In favorable circumstances this part of their character has often manifested itself in chivalric exploits.

Language, Literature, and Art.— See SPAIN, LANGUAGE, LITERATURE AND ART OF.

Population.— The population of continental and insular Spain as shown in the table of provinces in 1900 was 18,607,674; with the neighboring dependencies on the north and west coast of Africa (10,412) it amounted to 18,618,086. Of this total 9,087,821 were males, 9,530,265 females. The foreign population, chiefly resident in Barcelona, Cadiz, Gerona, and Madrid, numbered 42,400. The northern Basques, differing in race and language from the rest of Spain, number 440,000; the southern Moriscos number 60,000; there are 50,000 gypsies, and a small number of Jews.

Religion and Education.— The state religion is Roman Catholic. The Church is governed by 10 archbishops and 59 bishops, but two of the former and five of the latter have their dioceses beyond sea. The number of parishes is about 21,000. In 1837 all the convents of monks, with a few exceptions, were suppressed, and their revenues, subject to a provision for existing members, confiscated to the state. At the period of extinction the number of convents was 1,940, with 30,906 monks; there are still 161 with 1,684 monks, and 1,027 with 14,592 nuns. Since the last revolution toleration of all denominations has been decreed. Up to the end of the 18th century education in Spain stood at about the same level as in other continental nations, and it is a mistaken, though a current, notion to regard it as having been inferior to the schooling of the times. Since then the frequent political upheavals and revolutions have done much to cripple and retard the educational development of the country. Until 1808 public education was entirely in the hands of the clergy, but since then enactments have been passed transferring it to the care of the government, and though little money, owing to the poverty of the country, is granted from the public funds for the purposes of education, government superintendence has recently effected a very marked improvement.

Local Government.—The various provinces and communes are governed by their own municipal laws with local administration. Every commune has its own elected *ayuntamiento*, consisting of from 5 to 39 *regidores* or *consejales*, and presided over by the *alcalde*. Each province has its *diputacio provincial* or parliament, whose members are elected by the ayuntamientos, and in which are vested large political powers. It meets annually, and is permanently represented by the *consejo provincial*, a committee of its members.

History.—Spain was known to the Greeks and Romans as Spania, Hispania, and Iberia. The most ancient inhabitants of Spain appear to have been the Iberians, who also extended beyond the Pyrenees into Gaul as far as the Rhone. To

Digitized by Google

these afterward were joined certain tribes of Celts, who succeeded in making a settlement for themselves in the country after sanguinary contests with the aborigines. In process of time the two races were amalgamated into one, and went under the common appellation of Celtiberians. These occupied principally the high table-land in the centre of the country. The other parts were occupied by tribes of Iberians and Celts who had never intermingled. Pure Iberian tribes, from whom are descended the modern Basques, were to be found in the Pyrenees and on the coasts, while the unmixed Celts inhabited the northwestern corner of the country, corresponding to modern Galicia. The Phœnicians were the first civilized nation who made a descent on the Peninsula, and founded settlements there. Somewhat later the Greeks made their appearance, and among other colonies, founded Saguntum. But more important than any of these were the colonies established by the Carthaginians. The history of Spain, indeed, only properly begins with the Carthaginian invasion, about 238 B.C. Previous to that almost all that was known of the country was the existence of the two commercial states of Tartessus and Gades, both in the west. The former of these, supposed to have been the Tarshish of Scripture, was much visited by Phœnician ships by reason of its mineral wealth. After the first Punic war the Carthaginians began to establish themselves in Spain; large tracts of territory were brought under their sway by Hamilcar (238–229), and again by Hasdrubal (228–221); and among the cities founded by them was New Carthage, the modern Carthagena, which soon became a celebrated emporium. The subjected territory extended as far north as the Iberus (Ebro). Pressed by the Carthaginians, the Greek colonies of Saguntum and Emporiæ applied for aid to the Romans, who already had had their jealousy roused by the successes of their great rival. The Romans interfered, and a treaty was then concluded between the two great powers, in terms of which the Carthaginians bound themselves not to extend their conquests beyond the Iberus. The city of Saguntum was on the west side of the river, but under Roman protection, and the capture of it by Hannibal in 219 was the immediate cause of the second Punic war, which was partly carried on in Spain, and which in 206 caused the total expulsion of the Carthaginians from the Peninsula. The Romans now undertook the subjugation of the entire country, but in this they did not completely succeed until after a war of about 200 years' duration, in which the exploits of the Lusitanian Viriathus, the heroic resistance and final downfall of Numantia (133), and the temporary independence of a part of the country under the gallant Sertorius (84–73), form brilliant episodes. The Cantabrians, Asturians, and other tribes in the mountains of the north, were the last to yield, but were finally subjugated by Augustus and his generals, and Spain was converted into a Roman province. Previous to this the Peninsula had been divided by the Romans into two parts, an eastern and a western, separated from each other by the Iberus, called respectively Hispania Citerior and Hispania Ulterior; but Augustus made a new division of the country, forming it into three provinces — Tarraconensis, Bætica, and Lusitania. Tarraconensis and Lusitania were erected into imperial provinces, and administered by legates; while Bætica, which still remained for a long time a senatorial province, was placed under the authority of a proconsul invested with civil authority only. Until the reign of Antoninus Pius, who granted to all his subjects a uniform constitution and laws, the cities of Spain were ruled by different laws. These and other measures made Spain one of the most flourishing provinces of the empire, and a centre of Roman civilization. Some of the most distinguished Latin writers under the empire were natives of Spain, such as the two Senecas, Lucan, Martial, Quintilian, and others. Christianity was early introduced into Spain, and after the conversion of Constantine the Great became the dominant religion there. The disorganization and confusion consequent upon the fall of the Roman Empire facilitated the conquest of the country by the Vandals, who made themselves masters of a part of Southern Spain, which from them received the name of Vandalusia (now Andalusia); the Suevi, who established themselves in the region now known as Galicia; and the Alans, who gained possession of Lusitania, now Portugal. These, however, were soon afterward attacked by the Visigoths, who, after many years' struggle, succeeded in reducing the whole Peninsula to their sway. The Vandals of Andalusia, unable to withstand them, withdrew into Africa in 428, and from 467 to 484 the great Euric extended the kingdom of the Visigoths by the expulsion of the Romans, and gave them their first written laws; while Leovigild in 585 overthrew the kingdom of the Suevi in Galicia. Under Leovigild's successor, Reccared I., the introduction of the Catholic faith in 586 gave the corrupt Latin language the predominance over the Gothic, and after that time the unity of the Spanish nation was maintained by the Catholic religion and the political influence of the clergy. But after retaining the mastery of the country for nearly two centuries the Visigoths were in their turn conquered by the Arabs or Moors of Africa, who had come across at the invitation of the family of Alaric, the latter being eager to avenge themselves on their countrymen for being passed over in the election of king. King Roderic fell in the seven days' battle against Tarik at Xeres de la Frontera, in Andalusia, in 711. After that the greatest part of Spain became a province of the caliphs of Bagdad.

For some years after their conquest of Spain the Moors held it as a dependency of the province of North Africa; but it was afterward (717) governed by emirs appointed by the caliphs of Damascus. The policy of the Spanish emirs was to extend the Moorish dominion beyond the Pyrenees into Gaul, and the 40 years of their rule was marked by much bloodshed and anarchy, consequent on their disregard of internal affairs. About the year 756 Abd er Rhaman I., the last caliph of the dynasty of the Ommiades, having been driven from Damascus, where he was replaced by the Abassides, succeeded in overthrowing the government of the latter in Spain, and established the independent caliphate of Cordova, which under Abd er Rhaman III. and his son Hakkem II., who died in 976, reached its zenith of power and prosperity. After the deposition of Hescham III. the caliphate rapidly declined, for when that event took place the various governors of provinces declared themselves inde-

Digitized by Google

THE PALACE OF THE ESCORIAL.

Digitized by Google

Digitized by Google

pendent, and assumed the title of kings. Thus Arabian princes reigned at Saragossa, Toledo, Valencia, and Seville, where not only the language but also the manners of the Moors at that time prevailed almost universally. Still the free exercise of their religion was allowed to the Christians, and also the retention of their language, laws, and magistrates.

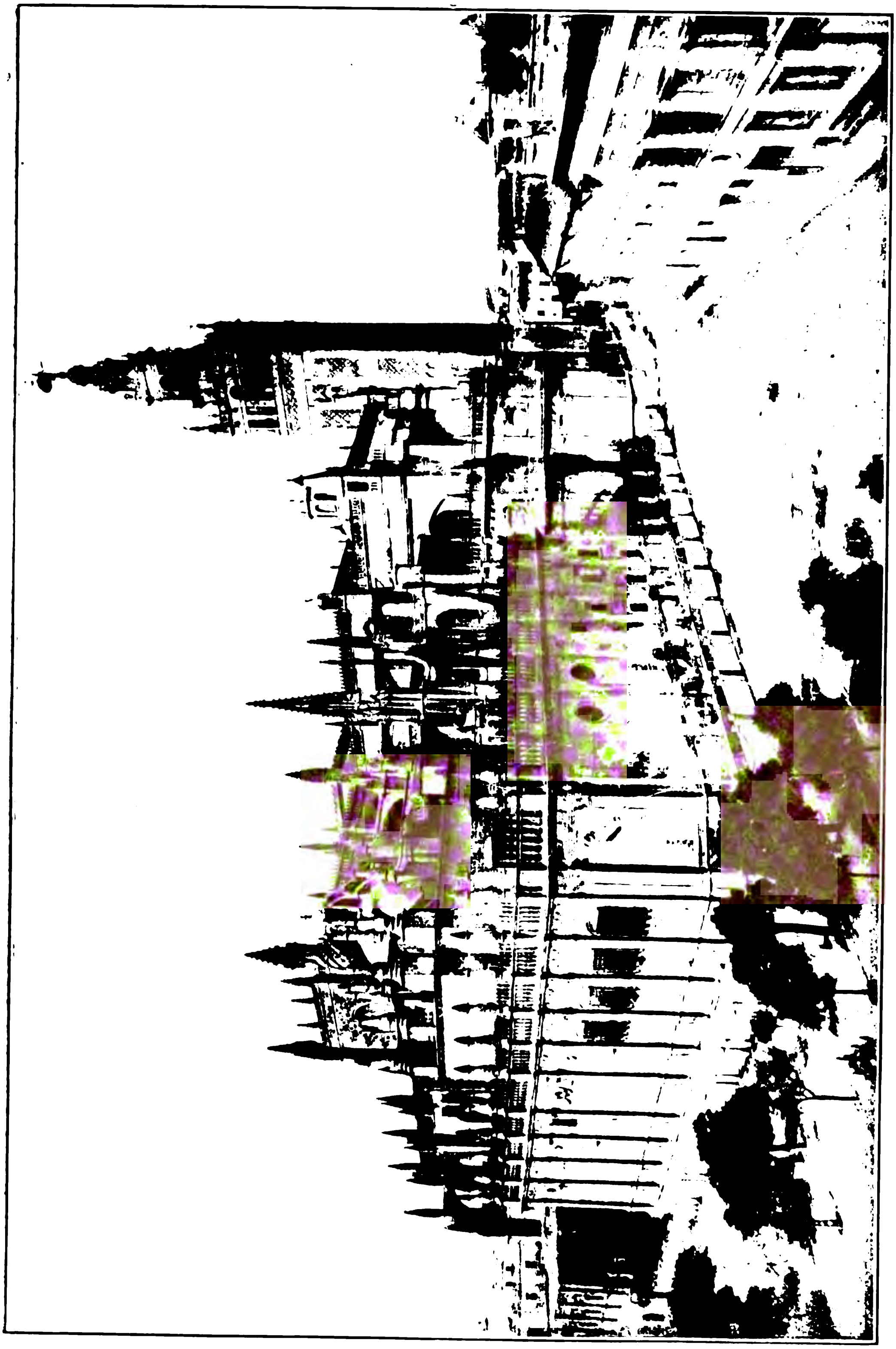
Meantime the Visigoths, who had succeeded in maintaining their independence in the mountains of Asturia and Galicia, founded under Pelayo in 718 the kingdom of Oviedo. The second successor of Pelayo, Alfonso I. the Catholic, conquered Galicia, with a part of Leon and Castile, and assumed the title of king of the Asturias. The remainder of Leon was conquered by Alfonso III., whose son Ordoño II., transferred his residence to the city of Leon, and called his dominion the kingdom of Leon (914). The kingdom of Navarre came into existence in the 9th century. It formed a part of the Spanish territory of Charlemagne, obtained by conquest from the Arabs, and extending south of the Pyrenees as far as the Ebro. Near the sources of the Ebro and Pisuerga arose even earlier the kingdom of Castile. At first a small republic, consisting of only a few towns, it appears afterward as a county with a considerably enlarged territory, and somewhat later its princes assumed the title of king. In 1037, after the death of the last king of Leon, Ferdinand I. of Castile united that kingdom with his own, and Castile was henceforth the most powerful Spanish state. Aragon, Galicia, Portugal, Murcia, and other states owed their origin to the prevailing custom of dividing a kingdom among the sons of a deceased monarch. Though frequently at war with each other the Christian princes generally united against their common foe the Moors, who were daily becoming less able to cope with them. About the end of the 11th century Mohammed of Cordova and Seville applied for assistance against Alfonso VI. of Leon and Castile to the Almoravides, the founders of the Empire of Morocco. In compliance with the request of Mohammed the Almoravides entered Spain, and gained some successes over Alfonso; but they then turned upon Mohammed himself, obliging him to yield them a portion of his territory, and the Almoravide sovereign was ultimately acknowledged sole monarch of Mohammedan Spain. The Almoravides, however, were overpowered in their turn by another Mohammedan tribe, the Almohades, about the middle of the 12th century. Meanwhile the Christian kings were making still further encroachments on the territory in possession of the Mohammedans, and after the great victory they obtained over the Almohades on the plains of Tolosa, in the Sierra Morena, in 1212, there remained to the Arabians only the kingdoms of Cordova and Granada, and even these were soon afterward obliged to recognize the supremacy of Castile. The two most important Christian states of Spain were Aragon and Castile, and they ultimately absorbed all the others. Aragon, which had been wrested from the Moors by Sancho III., and left as an independent kingdom to his son Ramiro, fell by inheritance in 1131 to the counts of Catalonia, and was afterward greatly enlarged under successive kings. Jayme I. wrested from the Moslems the island of Majorca in 1229, and the whole of the kingdom of Valencia in 1239. Pedro III. married Constance of Sicily, and notwithstanding the opposition of the Pope took possession of that island after the massacre of the Sicilian Vespers (see SICILIAN VESPERS) in 1282. Jayme II. effected the conquest of Sardinia in 1326, and Alfonso V. united Naples with his kingdom. Meanwhile the internal affairs of the kingdom had been thrown into confusion through civil dissension resulting from the heavy imposts laid upon the people; but a remedy was found in increasing the power of the Cortes. Aragon was the first Christian state in which the third estate obtained a legal position. The Cortes, consisting of representatives of the nobility, of the clergy, and of the towns, received more extensive privileges, and the king could not act in important matters without their consent. On the extinction of the Catalonian line of princes Ferdinand, infante of Castile, was elected king by the Cortes in 1412, and his descendants ruled over Aragon until, through the marriage of Ferdinand V. of Aragon with Isabella of Castile, Christian Spain was consolidated into one kingdom. Ferdinand I., second son of Sancho, was the first king of Castile in 1033, and as already mentioned joined the kingdom of Leon to the crown of Castile. He waged successful war with the Moors, took several towns, and exacted tribute from the Mohammedan king of Toledo. It is to this reign that the greater number of the exploits of the famous Rodriguez Diaz de Bivar, known under the name of Cid, belongs; and according to Viardot the establishment of the Cortes dates from the same reign. Under Alfonso VI. Castile acquired an accession of importance through the annexation to it of the crowns of Leon (which had become again disunited), Galicia, and Navarre, and above all through the conquest of Toledo and its territory, out of which was formed New Castile. Notwithstanding the success of its arms the country suffered much. Oppressed by taxes and desolated by war it was far from being in a prosperous condition. Under Ferdinand III., who ascended the throne in 1217, Cordova, Jaen, Alcala, Seville, Cadiz, and other places were wrested from the infidels; and again under his successor Alfonso X. (1252–80) further conquests were made, though some losses were also sustained. To the latter prince is due the introduction of the third estate into the national assemblies, and the adoption of the vernacular for public acts. Alfonso XI. (1324–50), like his predecessors, spent most of his time in warring with the Moors; he gained in 1340 the celebrated battle of Salados, and made himself master of Algesiras in 1344. In 1465 Henry IV. was deposed by his turbulent vassals, and the crown given to Isabella, whose marriage with Ferdinand of Aragon in 1469 led to such important results. The marriage of these two sovereigns did not lead immediately to a complete coalescence of the two kingdoms, for they retained the separate administration of their respective dominions. But in concert with their great minister Cardinal Ximenes, they proceeded harmoniously with the work of fusing all the states of Spain, which still differed in religion, customs, and laws, into a political and ecclesiastical unity, at the same time seeking to strengthen the royal authority at the expense of the clergy, the aristocracy, and the towns. By a severe administration of justice, and by the institution of the Santa Hermandad, or Holy Brotherhood — a body of about 2,000 police

Digitized by Google

armed and mounted for the purpose not only of putting down the robberies and violence which everywhere abounded, but also of forming a check on the power of the nobility — order was established throughout the country. The royal power was moreover strengthened and extended by the establishment of the Inquisition (q.v.). Warfare also was carried on by Ferdinand against the Moors of Granada, which, undertaken in 1481, culminated 10 years later in the reduction of the capital of that kingdom, which surrendered to Ferdinand 25 Nov. 1491. With the fall of Granada fell the Moslem empire in Spain, after having existed nearly seven centuries and a half, and Spain, with the exception of Navarre, was now consolidated into one great kingdom. An order was issued, 30 March 1492, for the expulsion of all Jews who did not submit to be baptized, whereupon nearly the whole race, rather than sacrifice their religion to their worldly interests, left the country. In this sentence of banishment the Moors were also included, and the departure of the industrious Jews and Moors proved a fatal blow to the flourishing commerce of the country, which was further affected by the discovery of America by Columbus in 1492, this being the means of withdrawing much of the activity of the nation from the improvement of the mother-country. While Spain consummated its complete political consolidation at home by the conquest of Navarre, the conquest of Naples by Gonsalvo, and still more the occupation of large portions of North, Central, and South America by Spanish generals, soon raised the new kingdom to the front rank of European powers. Ferdinand was succeeded in 1516 by his grandson Charles I. (Charles V. of Germany), who permanently united Castile and Aragon. (See CHARLES V.) At the beginning of his reign serious insurrections broke out in Valencia and Castile, where the people demanded a more liberal constitution; but they were soon quelled, and resulted in the abolition of the principal rights of the towns, the restriction of the powers of the Cortes, and a stronger attachment of the clergy and nobility to the crown. The victory of the Spaniards at Pavia 24 Feb. 1525, which made Francis I. the prisoner of Charles, and the expedition against Tunis and Algiers, extended the fame of the Spanish arms throughout Europe. But these wars, together with those carried on against the Protestants of Germany, against the people of Ghent in the Netherlands, and against Pope Clement VII. in Italy, exhausted the revenues of the country. The immense wealth that flowed in from Mexico, conquered by Cortes in 1518, and from Peru and Chile, conquered by Pizarro and Almagro in 1531, was not sufficient to supply the demands of the royal treasury, and though the taxes were largely increased a heavy debt had to be contracted. With the reign of Philip II. (1556–98), the son of Charles, the great monarchy began to decline. Oppression and religious intolerance, war, and insurrections, occasioned the loss of the Netherlands and depopulated the rest of the monarchy; and the conquest of Portugal, which remained united with Spain from 1581 to 1640, could not prevent its decay. England and Holland triumphed over the naval force of Spain, and destroyed her commerce; and Philip died in 1598 a bankrupt. This calamitous period was nevertheless the golden age of literature and art in Spain, and the Spanish language and fashions controlled the courts of Europe. Under the reign of the indolent and incapable Philip III. (1598–1621) the country took still greater strides toward decay. The Duke of Lerma, his insatiable favorite, in order to augment his own fortune and that of his partisans, squandered in a most scandalous manner the public revenues; and he struck another blow at the commerce of the country by expelling, in 1609, the last remnants of the Moriscos, to the number of 600,000. Equally damaging to the interests of the country was the reign of Philip IV. (1621–65), notwithstanding some energetic measures taken by Olivarez, the able minister of that monarch. The wars which were carried on in Germany, Italy, the Netherlands and France — the war with the last-named country ending in the loss to Spain of Roussillon — helped to complete the ruin of the country and stirred up revolts in Catalonia, Andalusia, and Portugal. The civil war in Catalonia lasted about 10 years, and in 1640 Portugal recovered her independence. The son of Philip IV., Charles II. (1665–1700), a prince weak alike in mind and body, was obliged, after disastrous wars, to cede to France many places in the Netherlands and Franche Comté. The population of Spain, which had amounted to 11,000,000 in 1688, fell off to about 8,000,000 at the beginning of the 18th century.

Charles II., the last Spanish sovereign of the race of Hapsburg, in his second will made Philip of Anjou, a grandson of his sister, the consort of Louis XIV., sole heir of his dominions, in order to prevent the division of the Spanish monarchy, which had been resolved on in a treaty between England, Holland, and France. Louis XIV. acknowledged his grandson king, according to the testament; but the Emperor Leopold I., of the race of Hapsburg, laid claim to the throne, while William III., king of England and stadtholder of Holland, was in favor of a division of the monarchy for the sake of preserving the balance of power in Europe. The measures of Louis XIV. at length brought on a war with England. Thus began the war of the Spanish Succession, which lasted 12 years, and in which the Bourbon, Philip V., after many changes of fortune, succeeded in maintaining himself, by the victories of Berwick and Vendôme, on the Spanish throne in opposition to Charles of Austria (afterward the Emperor Charles VI.). But by the Peace of Utrecht in 1713 he was obliged to resign the Spanish dependencies in Europe — Naples, Sardinia, Parma, Milan, and the Netherlands to Austria, and Sicily to Savoy. England likewise retained Gibraltar and Minorca, the latter of which was restored somewhat later. Under the Bourbons the nation lost its last constitutional rights; Aragon, Catalonia, and Valencia were treated by Philip as conquered countries. The last diet of the Cortes held in Castile was in 1713, and in Aragon in 1720. Biscay and Navarre alone retained some of their privileges. The ambition of Cardinal Alberoni involved Europe for a short time in confusion. Spain in 1735 again obtained possession of the Two Sicilies for the Infant Carlos, and of Parma for the Infant Philip in 1748. Ferdinand VI. (1746–59) succeeded his father Philip, but being a prey to hypochondria took no active part in the government. With his step-brother, Charles III. (1759–88), previously king of Naples, an en-

Digitized by Google



Cathedral and Alcazar at Seville.

Digitized by Google

lightened prince, better days dawned for Spain. Under his reign the Bourbon family compact of 1761 involved Spain, to its injury, in the war between the French and British. The expeditions against Algiers likewise miscarried, as did the siege of Gibraltar in the war of 1779-83. Yet this did not disturb the course of the internal administration, to the improvement of which men like Aranda, Campomanes, Olavides, and Florida Blanca devoted themselves. They provided particularly for the advancement of agriculture, the useful arts, and commerce, and this had a beneficial effect on the population, which now rapidly increased. The progress in improvement became even more marked during the early part of the reign of Charles IV. (1788-1808), who at first pursued the reforming policy of his father; but in 1792, when Florida Blanca was superseded by Godoy as prime minister, he fell under the pernicious influence of that favorite. Spain at first entered with zeal into the war against the French Republic; but by the influence of the favorite the discreditable Peace of Basel was concluded, by which Spain resigned Santo Domingo to France, an offensive and defensive alliance with France was entered on (1796), and war declared against Britain. In 1797 the Spanish fleet was defeated near Cape St. Vincent, Minorca and Trinidad occupied by the English, and all the ports of Spain blockaded. By the Peace of Amiens in 1802 the British were confirmed in their possession of Trinidad. In 1801, at the instigation of France, military operations were commenced against Portugal, which was obliged to cede the province of Olivença to Spain at the Peace of Badajoz in 1802, while France raised the Duke of Parma to the dignity of king of Etruria in 1801, Spain in return ceding Louisiana to France. Charles IV., on the renewal of the war between Britain and France in 1803, having purchased permission to remain neutral by a monthly tribute of 6,000,000 francs to Napoleon, the British seized the Spanish galleons, and thereby forced Spain to declare war against Britain. The victory of the British at Trafalgar, 21 Oct. 1805, destroyed its naval power. The misery occasioned by the unfortunate wars carried on by Spain at this time led to the formation of a powerful party against the unscrupulous Godoy, who was mainly instrumental in bringing about these wars. Some feeble efforts were made by him to free Spain from French domination; but the success of Napoleon in his war with Prussia thwarted those, and in terms of the alliance subsisting between Spain and France a requisition of Napoleon to despatch two Spanish armies to Denmark and Tuscany respectively had to be complied with. Spain received a further humiliation by the Treaty of Fontainebleau respecting the division of Portugal, in consequence of which French troops were marched into the country. Toward the end of 1807 large bodies of French troops entered Spain at different points, and occupied on one pretense or another some of the strongest fortresses in the north. The entrance of a French army 35,000 strong in March 1808, raised the numbers of French troops in the country to 100,000, and with Murat at their head they now marched on Madrid. Godoy, in despair of his life, counseled the flight of the king and queen to Mexico. The project got wind; the people broke into open insurrection, and the reign not only of the favorite but of his master also was at an end. Charles IV. abdicated in favor of his son, the Prince of Asturias, who ascended the throne as Ferdinand VII. Ferdinand made a public entry into Madrid, which had been occupied by Murat, grand duke of Berg, the day previous. He informed Napoleon of his assumption of the royal power; but the emperor caused the whole family to be conveyed to Bayonne. Charles IV., who had retracted his resignation of the crown, and Ferdinand VII., the new king, were now both in the hands of Napoleon. Taking advantage therefore of the opportunity, he extorted from each of them, as well as from the Infantes Don Carlos and Don Antonio, a resignation of their claims to the Spanish crown. The crown, which had already been refused by his brother, Louis, king of Holland, was now offered to another brother, Joseph, the king of Naples, by whom it was accepted. The Council of Castile, the chief political body of Spain, when informed of the treaties of Bayonne, was at length induced to give a reluctant assent to the accession of Joseph. A junta of 150 Spanish notables which had been summoned to Bayonne accepted a constitution proposed by Napoleon, and a day or two after Joseph left Bayonne for Madrid. The Spanish people, who were so little taken into account in these changes, were by no means passive spectators of them. Insurrections had already broken out immediately after the abdication of Charles in May. The people in Asturias first took up arms; Aragon, Seville, and Badajoz followed. Palafox carried from Bayonne to Saragossa the order of Ferdinand that the people should arm; and the supreme junta received permission to assemble the Cortes. Revolution broke out everywhere, which the French were too weak to resist. Moncey retreated to Valencia; and Generals Dupont and Wedel were beaten at Baylen. The junta at Seville had issued a proclamation calling the people to arms, and the Council of Castile decreed a levy of 300,000 men. The French squadron at Cadiz surrendered to the Spaniards, and six days later an insurrection broke out in Portugal. On 4 July 1808, the alliance of Great Britain with the Spanish nation was proclaimed, and a struggle began, which, whatever opinion may be entertained respecting the conduct of Napoleon, everyone will admit to have brought with it, as far as respected Spain, little but evil. Marshal Bessières was successful in the battle at Medina del Rio Secco, over General Cuesta; but the affair at Baylen above mentioned decided the retreat of the French from Madrid, and, 23 August Castanos entered the city. In the meantime Sir Arthur Wellesley (Wellington) had disembarked in Portugal at the head of the British forces, and on 21 August gained the first important battle in the Peninsular war, defeating the French under Junot at Vimeiro. On 30 August the convention of Cintra was concluded, by which the French agreed to evacuate Portugal. A central junta under Florida Blanca was organized at Aranjuez toward the end of September; but unity did not prevail in it, and the favorable moment was allowed to escape. On 6 November Napoleon reached the Ebro at the head of a large force, and by a succession of victories gained by his generals under his direction his way was opened to Madrid, which he

Digitized by Google

entered on 4 December. The central junta now retired to Badajoz, and afterward to Seville. The Spaniards believed that the success of the French was owing to treachery, and this suspicion occasioned the assassination of more than one of their generals. The French indeed gained many victories and took many fortresses; but the conquerors remained masters only of the places which they occupied. Everywhere the invading troops were surrounded and harassed by the attacks of the Spanish guerrillas. No line of communication was safe for the French: their means of support failed. In vain did Napoleon, 4 Dec. 1808, abolish the feudal privileges and the Inquisition; in vain did Joseph try every means to win the love of the people; nothing could avail against the hatred of a Gallic yoke. Austria now declared war, and Napoleon was obliged in January 1809, to leave the conduct of the war in the Peninsula to his marshals — a step which the Spaniards considered as equal to a victory. During the following five years the French generals did all that talent and courage could do; but the charm of Napoleon's presence was wanting, and Wellington finally triumphed over them. See PENINSULAR WAR.

After Pampeluna had fallen, 31 Oct. 1813, no French soldier was left on the Spanish territory except in Barcelona and some other places in Catalonia. Wellington attacked the enemy on the fortified banks of the Nivelle 10 November, and Soult retreated into the camp of Bayonne. On 26 Feb. 1814, Wellington fought a battle with Soult at Orthez, by which the latter was driven from his strong position, and obliged to retreat, in great disorder, to the Upper Garonne. Wellington followed the French under Soult to Toulouse, where the bloody battle of 10 April and the occupation of the place put an end to the war.

The Cortes had already held its first session and had resolved that Ferdinand VII. should swear to preserve the constitution before he should be recognized as king. At their invitation Ferdinand now returned to Spain, but declared the constitution null and void; the Inquisition was revived, despotism was restored, and the greater part of the reforms introduced under Charles III. were subsequently annulled. Ferdinand bore down all opposition with a high hand, and for six years (1814–20) reigned with absolute power. From 1814 to 1819 there were 25 changes in the ministry, mostly sudden, and attended with severities. They were produced by the influence of the *camarilla*, or persons in the personal service of the king. Every attempt to save the state was frustrated by such counsellors, and the prestige of Spain was further lowered by the loss of the American colonies, an attempt to reconquer which only resulted in a miserable failure. On 1 Jan. 1820, a military insurrection under Riego broke out, for the purpose of restoring the constitution of 1812. It spread with great rapidity; several generals, as O'Donnell and Freyre, who were despatched to suppress it, joined the insurgents, and Ferdinand, abandoned by his own troops, was obliged to swear to observe the constitution of 1812. Among other reforms the Inquisition was abolished. The Cortes being assembled, immediately set themselves to frame such measures as should be calculated to restore tranquillity to the distracted country. But this was a task well nigh impossible under the circumstances. The country was divided into opposing factions — those who favored the restoration of its ancient power and privileges to the crown, and those, on the other hand, who advocated liberal or ultra-liberal measures, and the measures passed had no effect in allaying the discontent. Guerrilla bands were organized in the provinces in the cause of church and king, and obtained the name of "armies of the faith." There was even established at Seo d'Urgel in July 1822, what was called "a regency during the captivity of the king." The government, however, was powerful enough to disperse these guerrilla bands and drive the regency into France. In these civil disturbances dreadful atrocities were committed on both sides. In the meantime France, at the Congress of Verona in October 1822, had agreed with the courts of eastern Europe upon an armed intervention in Spain. The Spanish government was called upon to restore the royal sovereignty, and to change the constitution; and when they declined to comply a French army 100,000 strong, under the Duke of Angoulême, crossed the Pyrenees in the spring of 1823. By means of this force Ferdinand was restored to absolute power, and immediately revoked all the decrees passed by the constitutional government between March 1820 and October 1823. The Inquisition, indeed, was not restored; but the secular tribunals supplied its place, and performed deeds of vengeance of the most atrocious description. The whole Spanish army was now disbanded, and its place supplied by the "army of the faith," who plundered and murdered the constitutionalists to their hearts' content. It is computed that 40,000 constitutionalists, chiefly of the educated classes, were thrown into prison. To restrain the violence of party fury a treaty had been concluded with France, stipulating for the maintenance of a French force of 45,000 men in the country, until the Spanish army could be organized. It was only in 1827 that the French evacuated Spain. The personal moderation of the king toward the constitutionalists led to the formation of a plot by the absolutists to compel him to abdicate, and to raise Don Carlos, his brother, to the throne (thence their name of *Carlistas*). Several insurrections were set on foot by these Carlists, which were attended with numerous executions. In 1830 Ferdinand was persuaded by his wife, Maria Christina, a Neapolitan princess, to abolish, by the pragmatic sanction of 29 March, the salic law of the Bourbon family, which excluded the daughters of the king from the throne. In consequence of the abolition of this law the succession passed from Don Carlos to Ferdinand's daughter, the Infanta Isabel. Don Carlos and his party protested against this measure, and the death of Ferdinand in 1833 was the signal for civil war. Isabella was at once acknowledged by the leading powers of Europe, and proclaimed without opposition in all the midland and southern provinces of Spain. It was otherwise in the north, particularly in the Basque provinces; there the inhabitants took up arms in behalf of Don Carlos, and proclaimed him king, under the title of Charles V. Christina had the joint support of the moderados and the liberals, and in order to attach them to her still more a royal decree was issued in April 1834, granting a constitution

Digitized by Google

A GROUP OF PEASANTS FROM THE PROVINCE OF LEON, IN THEIR CHARACTERISTIC COSTUMES.

Digitized by Google

with two chambers. The Carlists, under the command of Zumalacarreguy, were at first successful, but on his death their cause began to decline, and the skilful leadership of Cabrera failed to retrieve the fortunes of the party. During this struggle England and France allowed men to be recruited within their territories for the cause of the queen, and an army of 10,000 went from England to join the royal troops. The chief of the royalist generals were Espartero and O'Donnell, under whose leadership the war was brought to an end in 1840. Though the civil war had thus been brought to a successful termination, Spain had by no means been restored to a state of tranquillity. Christina failed to satisfy the ultra-liberals, and rather than consent to have a colleague in the regency, as it was now thought expedient she should have, resigned 12 Oct. 1840, and sailed for France. In May 1841, the Cortes conferred the office of regent on Espartero, and that of guardian to the queen on Arguelles. Espartero seems to have had the good of his country at heart, but he had a most difficult card to play. Every reform which he attempted gave offense to some party, and to whatever side he turned he met only with opponents numerous, resolute, and influential. Insurrections broke out in various quarters; and Espartero, checked and hampered on all hands, at last left the country and sailed for England. Queen Isabella was declared of age by the Cortes in 1843, and henceforth the government was carried on in her name. She was married on 10 Oct. 1845, to her cousin, Don Francisco d'Assiz, her only sister, Louisa, being on the same day married to Louis Philippe's son, the Duke of Montpensier. The outbreak of the French revolution of 1848 caused much less commotion in Spain than in several other continental states. Any revolutionary movements that took place were easily repressed by Narvaez, a minister of prudence and energy, who was then at the head of the government. Narvaez, however, found no small difficulty in maintaining his position. The court was a mere focus of intrigue, and the most important political changes were constantly threatened to be effected by the most frivolous and contemptible means. Early in 1851 he was compelled to resign; and till 1854 a number of short-lived and weak ministries, most of which had reactionary tendencies, succeeded each other. At the head of the last of them was Sartorius, whose measures were so unpopular that insurrections broke out in various quarters; and he and his colleagues, after trying in vain to suppress them, were obliged to save themselves by flight on the 17th of July 1854. Espartero, who had some time before returned to Spain, was now charged with the formation of a government in accordance with the wishes of the nation. Before consenting to undertake this task he made two stipulations — the one that the queen-mother should be exiled, the other that the constituent Cortes should be assembled. On obtaining these concessions he formed a coalition ministry, himself holding the office of president, and General O'Donnell that of minister of war. The coalition ministry did not, however, work harmoniously; and Espartero, after holding his position with some difficulty till 14 July 1856, was obliged to give place to another ministry, with O'Donnell at its head, which only existed three months. Narvaez was now called to the head of affairs (October 1856). But in July 1858, O'Donnell was again entrusted with the formation of a ministry, which, being more liberal than the previous ones, endured for a period of five years, during which Spain enjoyed comparative tranquillity. In 1858 Spain shared in the French expedition against Anam, to avenge the persecution of Catholic missionaries and native Christians, which had been going on for a series of years. On 22 Oct. 1859, war was declared against Morocco, which, it was alleged, had attacked the Spanish possessions situated on the northern coast of that state. Under the leadership of O'Donnell it was carried to a successful conclusion, and a treaty of peace was signed on 26 April 1860, in terms of which 20,000,000 piastres were paid to the Spaniards by way of indemnification. These foreign wars led to a considerable increase of the army and navy, promoted peace at home, and greatly raised the reputation and influence of Spain abroad. In 1860 an unsuccessful attempt was made to overthrow the government of Isabella by the Count of Montemolin, the eldest son of Don Carlos, in whose favor the latter had in 1845 abandoned his claim to the Spanish throne. In 1861 Spain joined Britain and France in sending an expedition to Mexico to obtain redress of grievances. The same year Spain resumed possession of her former colony of Santo Domingo. On 18 March the last president of that republic, Santana, issued a proclamation announcing the union of that state with Spain; and on 20 May the queen signed the decree by which the annexation was accepted. In 1863, however, a revolt broke out, and after some fighting, which continued into the following year, Spain relinquished the possession once more. A quarrel at this time broke out between Spain and Peru, in consequence of which the Spaniards seized the Chincha Islands by way of material guarantee; but in the early part of 1865 the differences between the two governments were adjusted, and the Chincha Islands restored to the Peruvian authorities. A more serious rupture took place in the same year with Chile, which led to a war between the two countries. The Chileans were supported by Peru, Ecuador, and Bolivia; but Spain had not very much to fear from this combination, though at the same time, as might have been expected, the war procured her little either of honor or profit. A military insurrection broke out in Spain toward the end of 1865, under the leadership of General Prim, but he and his adherents were forced to flee before the royal troops. Prim effected his escape to Portugal, but in the following year another attempt at insurrection was made. On 22 June a regiment of artillery, quartered in Madrid, mutinied in their barracks; and after murdering several of their officers marched through the streets of the city calling upon the people to rise in the name of "Prim and the republic." The active measures, however, of the prime minister, Marshal O'Donnell, soon put down the revolt. An equally abortive rising, though on a larger scale, took place in August 1867, in Aragon, Catalonia, Valencia, and elsewhere, where bands of armed men made their appearance, and were in some instances joined by the mayors of towns and other functionaries. The movement in a short time wholly collapsed.

Digitized by Google

and several persons engaged in it were taken prisoners and executed. But the revolution of 1868 had a very different issue. The conduct of the queen had alienated all feelings of loyalty in the breasts of her subjects. The forms of the constitution had been abused, and made the machinery of arbitrary and oppressive rule, and the people were weary of a system which repressed all freedom of thought and rights of conscience, which placed the education of the young in the hands of Jesuits, and under which they had lost all respect for their ministers and all attachment to the crown. In the month of April insurrectionary movements broke out in Catalonia, and the province was placed in a state of siege. In July several Spanish generals were arrested by the government, and without any form of trial sent into exile. The revolution burst forth in September. On the 17th of that month General Prim arrived at Cadiz, where the exiled generals also arrived two days later, and immediately lent themselves to the movement. Meanwhile a proclamation had been issued calling the people to arms. Marshal Serrano, formerly president of the senate, placed himself at the head of the movement and the whole of Andalusia pronounced for the revolution. The Spanish ministry resigned, and General Concha was appointed by the queen president of the council. The Marquis de Novaliches commanded the royal army, and marched upon Cordova, which was occupied by the insurgents. At Burgos a severe conflict took place, which resulted in the royal troops fraternizing with the people. Juntas were established in the different towns, which one after another raised the flag of rebellion. The defeat of Novaliches at Puerta Alcalen and the formation of a provisory junta at Madrid determined Isabella to flee the country and take refuge in France. Immediately after her flight the fall of the Bourbons was solemnly proclaimed, and one of the first acts of the juntas was to recognize universal suffrage as a principle of the future constitution. Serrano entered Madrid at the head of the revolutionary troops on 3 October and was received with the utmost enthusiasm by the inhabitants. A few days later a provisional ministry was formed, "to lead the nation to liberty, and not allow it to perish in anarchy." Decrees were passed suppressing the Society of the Jesuits, declaring the absolute freedom of primary education, and restoring the liberty of the press. Thus was accomplished with little violence and less bloodshed a revolution which marks one of the most important eras in Spanish history. The Cortes of 1868 declared for the monarchical form of government; but it was no easy task to find a prince both able and willing to fill the hazardous post of king. After fruitless negotiations with several princes, which, in the case of one of them, the Prince of Hohenzollern, led indirectly to the disastrous Franco-German war (q.v.) of 1870, the crown was at length accepted by Amadeus, the second son of Victor Emmanuel, and on the 16th of November 1870, he was formally elected as king by the Cortes. Meanwhile insurrectionary movements in several of the provinces had disturbed the peace of the country, but were forcibly suppressed. The new constitution was promulgated 6 June 1869, and Serrano appointed regent until a king was elected. The two years' reign of Amadeus I. failed to give peace to the much disturbed country. Parties were numerous and irreconcilable. One ministry had to give place to another, each successive change making matters worse instead of better. To crown all, in April 1872, the Carlist insurrection, which had been for some time threatening, burst forth. Risings took place simultaneously, under old chiefs of the party, in Aragon, Navarre, and the Basque Provinces; and bands also rapidly formed in Leon, Castile, and elsewhere. The cry of "Viva Carlos VII." was heard on all sides. No time was lost by the government in despatching Marshal Serrano to the scene of action. He succeeded in driving the insurgents before him, and coming up with the main body on 4 May, at Oroquieta, defeated them. The check they received was, however, only temporary, as they still kept up a species of guerrilla warfare, and the year 1872 closed amidst widespread confusion in the provinces, and excitement in the capital itself. "The Carlists in the north, the federalists in the south, overran the country, exacting contributions, cutting the railways and telegraph wires, inflicting heavy damages upon the state and on private families, putting a stop to all commercial intercourse, undermining local trade, protecting and facilitating smuggling, and obtaining unlimited authority wherever they went"; and in this state of disorganization the country continued long after all active fighting had ceased. Disaffection in the army added to the strife of parties, and the many opposing manifestations of public opinion at length determined the king to resign a crown the wearing of which had caused him nothing but anxiety and unrest. He accordingly abdicated on 11 Feb. 1873; and immediately thereupon the Cortes, by a majority of votes, declared for a republic, which was officially proclaimed at Madrid on 16 February. This was followed by political complications of the most chaotic description, a state of affairs which the Carlists were not slow in taking advantage of. Not only, however, were the Carlists active, but other insurrectionary movements, consequent on the general discontent, combined to complicate the difficulties of the government. On 8 June the form of government, which had been the subject of much dispute, was, by an almost unanimous vote of the Cortes, definitely declared to be that of a federal republic. The ministers under it were as short-lived as previously. On 21 September Castelar, who at that time was president, was invested with dictatorial powers by a resolution of the Cortes, who voted their own suspension till 3 Jan. 1874. At the expiration of that period matters were in no way improved. Public opinion was wholly disorganized, and the Carlist war had gained formidable dimensions. January 3 saw another revolution of government; the Cortes had reassembled, and on a motion being made for the approval of Castelar's exercise of authority during the recess it was negatived by a large majority. Castelar at once presented the resignation of himself and cabinet. As soon as this event was known out of doors, General Pavia, the captain-general of Madrid, at the head of his troops, entered the chamber, and forcibly dissolved the Cortes; and having assembled the chiefs of the revolution of 1868, and leading men of all political parties, justified his conduct by the urgency of the case, and desired them to

Digitized by Google

form a new coalition ministry. The parties now placed in power, with Serrano at their head, were the same with those who made the revolution of 1868 and the constitution of 1869. During this new revolution Madrid remained tranquil; but in Saragossa, Barcelona, and Valencia volunteers were arrayed by the communal authorities against the troops of the government, and barricades were raised. The struggle, however, was of short duration, and soon quelled. Within ten days after the inauguration of the new government a striking military success, in the capture of Carthagena from the disaffected, came to give it credit. In the north the Carlist war still raged, and became more and more formidable. Bilbao made a stubborn resistance to the government troops, but ultimately fell, and this success was followed by a few others; but at the battle of Estella, fought on 27 June, the Carlists obtained a signal victory over the republicans, who lost nearly 5,000 men in killed, wounded, and prisoners. The Carlists now overran the northeastern provinces, the fortresses only holding out against them. On 15 July, after a terrible bombardment, Cuenca fell into their hands. By the beginning of September the pretender's troops had entered several towns in different parts of Spain, though they had been, for the most part, unable to retain their acquisitions. The tide of success, however, again turned against the Carlists. They met with a signal defeat near Pampeluna on 25 September and again at Irun on 11 November; but the republicans failed to follow up their successes or act as if they had any desire to bring the war to a speedy conclusion. Meanwhile another political change was in contemplation. The Alfonsists, or advocates of the Prince of Asturias, son of the ex-queen, consisting of a large majority of the middle and upper classes of society, had been working steadily in his interests. On the prince's 17th birthday addresses had been presented to him at Sandhurst, in England, where he was pursuing his military studies as cadet; and on the last day of the year it was announced that General Martinez Campos, proclaiming Prince Alfonso as king, had entered Valencia with two brigades. On the same day he was proclaimed in Madrid under the title of Alfonso XII. On 9 June 1875, the new king landed at Barcelona, and assumed the government of Spain. The Carlist rebellion dragged itself on for more than a year after this event, but with fainter and fainter hopes of success. On 22 Feb. 1876, five battalions of Carlists surrendered at Tolosa to General Campos, and four days later Don Carlos fled to France. On 20 March following the young king made a triumphal entry into Madrid. Spain enjoyed a time of peace until his death in his 29th year, November 1885. His wife, Christina of Austria, was proclaimed regent after the birth in 1886 of her posthumous son, who is now king under the title of Alfonso XIII. Besides her struggles with the Carlists and others at home, Spain had to contend from 1868 to 1878, and again from 1895 onward, against insurgents in Cuba, where rebellion seemed almost the normal state of affairs. The United States intervened in 1898, and war ensued, resulting in the defeat of Spain, the almost complete destruction of her navy, and the loss of her American and Asiatic colonies. (See UNITED STATES, WAR WITH SPAIN.) For the history of the Moorish dominion consult the works of Conde, Aschbach, and Dozy; for the times of Ferdinand and Isabella and of Philip II., those of Prescott; and for the Peninsular war, those of Foy, Southey, Napier, Suchet, etc.

Bibliography.— Amicis, 'Spain and the Spaniards' (1885); Burke, 'History of Spain' (1900); Cavanille, 'Historia de España' (1861-5); Dierck, 'Geschichte Spaniens von den frühesten Zeiten bis auf die Gegenwart' (1894-5); Hume, 'Spain, its Greatness and Decay' (1897); 'Modern Spain, 1788-1898' (1899); 'History of the Spanish People' (1901); Lafuente, 'Historia General de España' (1888); Montesa and Manrique, 'Historia de la Legislacion, etc., de España' (1861-4), and 'Historia General de España' (1890); Poole, 'The Moors in Spain' (1886); Root, 'Spain and its Colonies' (1898); Wilson, 'The Downfall of Spain: Naval History of the Spanish-American War' (1899).

Spain, Language, Literature, and Art of. *Language.*— The Spanish language belongs to the group known as the Romance or Romanic languages. (See ROMANCE LANGUAGES.) Besides being the language of Spain it is the language of Mexico, and a great part of South America. The lengthened duration in Spain of Roman institutions, to which that country assimilated itself more completely than any other nation of Europe; and the firmer establishment there of the Church, which perpetuated the literary traditions of Rome — caused a closer approximation of the Spanish to the Latin than even the Italian. The conquest of the country by the Visigoths naturally exercised a powerful influence on the development of the language; and it has been estimated that one tenth of the words in Spanish are of Teutonic origin. The prolonged occupation of the country by the Moors had likewise an important influence on the constitution of the language, and gave it somewhat of an Oriental tinge. There are a good many words of Arabic origin in Spanish. A number of different dialects developed themselves at an early date, but of these the Castilian took the lead, and came to be considered as the standard of Spanish, becoming the idiom of the court and the learned. Portuguese was at one time but a Spanish dialect, but it has succeeded in gaining recognition as a separate language. The Castilian idiom originated in the mountains of the interior of Spain, and like that of the Doric mountaineers among the Greeks was characterized by deep and open tones, which now distinguish the Spanish from the Portuguese. The latter we may compare to the Ionic dialect in the Greek language. The Spanish language has 27 letters or signs of as many distinct sounds, of which two, *ll* and *ñ* (pronounced like *lli* in brilliant and *ni* in union) are peculiar to it. All the letters are pronounced, except *h*, whatever their position may be. The vowels, unlike the English, remain invariable in sound; thus *a* always sounds like *a* in far, *o* like *o* in go, etc. Some of the consonants have peculiar sounds, as *j*, which is always pronounced like the German *ch*, or *ch* in the Scotch word loch; *g* has likewise the same sound when it precedes *e* or *i*; *z* invariably, and *c* before *e* and *i*, are pronounced like the English *th*; lastly, *b* is sometimes pronounced *v*, and *vice versa*, the more correct sound being one intermediate between *b* and *v*. There are only the two genders

Digitized by Google

for nouns — masculine and feminine; but the article has three forms — *el, la,* and *lo;* the last is employed before an adjective to give it the force of a noun. The plural is formed by adding *s* or *es* to the singular. There is properly no declension, prepositions being used instead of inflections. The Spanish is unusually rich in augmentative and diminutive terminations, which have gradually become the regular and exclusive means of adding to the original meaning of words the idea of greatness or smallness, admiration or contempt. The comparison of adjectives is effected by prefixing to the positive *mas,* more, for the comparative, and the same with the definitive article for the superlative; though, unlike the kindred idioms of Italian and French, there is an absolute superlative in Spanish formed by affixing *isimo* to the positive. In the subjunctive of the verb there are four more tenses than the kindred languages possess, namely, two simple tenses, the future and the second conditional; and two compound tenses, the future perfect and the conditional perfect. The Spanish has only three conjugations, but, unlike the other Romance languages, it has a double set of auxiliary verbs, *haber* and *tener, ser* and *estar,* and uses the reflexive form of the verb more extensively than any other European language. As an instrument of science and philosophy the Spanish is weak; but for poetic productions it is unrivaled, being at once harmonious, sonorous, and precise, abounding in imagery and metaphor, and peculiarly fitted to express the dignified and the pathetic. The best native grammars are those of the Spanish Academy, of Salva, and of Bello and Cuervo; of foreign ones in English, those of Schele de Vere, Prof. W. J. Knapp, C. M. Sauer, and M. M. Ramsey. Consult, also, Diez, 'Grammatik der Romanischen Sprachen.' Of dictionaries those of the Spanish Academy and of R. J. Dominguez (both for Spaniards), the Spanish and German by Tolhausen, and the Spanish and English (pronouncing) by Velazquez, are especially valuable.

Literature.— The national literature of Spain dates only from the 12th century; but the literary life of the people is much older, as under the rule of the Romans Spain, which became a chief seat of Roman civilization, was also one of the centres of Latin literature. In Spain, as elsewhere, the first stage of literary development was in the province of poetry. The time when Spanish poetry began to flourish coincides with the origin of the Italian epic, being just at the period when the Provençal poetry expired, in the middle of the 14th century. The age of the Provençal poetry could not last long in Spain. The life of the Spaniard, filled with battle and toil, was too grave to allow him to be satisfied with poetry of so gay and often trifling a character. Only at the court of Aragon, and for a short time at that of the king of Castile, were there courts of love and wandering minstrels. The more Castile extended its power from the centre of Spain the more did the Provençal poetry retire from Aragon, Catalonia, and Valencia to France. Castilian poetry began with the ballad, passed over to the romance, and reached its highest point in the drama, and in each of these departments always remained of a decidedly romantic character. Spanish poetry differs from the Italian by a peculiar mixture of romantic fervor, frequently of an Oriental kind, with deep gravity. The Moors may have added to this spirit, besides having introduced into Spanish fiction the fairy world of the East. Spanish poetry proceeds always with a solemn pace. Its plays of wit are heavy, and its fondness for allegory excessive. The perfection of the intrigue is one of the great merits of Spanish writers, and they have served as models to the rest of Europe. A great peculiarity of Spanish versification is found in the *redondillas,* which became not only the standing metre of the ballad but also of the drama, and in the assonances, which the Spaniards carried to the highest perfection. Redondillas, in their later form, are strophes of four lines in trochaic verses, mostly of four feet, and are peculiarly adapted for Spanish poetry. In the Spanish sonnets, prior to the connection with Italy, they assumed the most popular character. The rhyme alone did not satisfy the writers, but the assonance was carried through whole lines. The song was the natural growth of the war-like period of Spain, and served to commemorate martial exploits. No language has such a store of ballads as the Spanish; but they are, particularly the earlier ones, little more than simple childlike relations of chivalrous deeds. They may be properly divided into the chivalrous (derived especially from the fabulous history of Charlemagne, in which are mingled also tales of Moorish and Spanish heroes, as Don Gayferos, the Moorish Calaynos, Count Alarcos, etc.) and the historical; of the latter kind an endless number originated during the struggle with the Moors. After those which belong to the early times of these conflicts, in the 9th and 10th centuries, there arose the brilliant ballads relating to the Cid, the hero of the first Castilian king, Ferdinand. Their nature is fully exhibited to us in probably the earliest poem of length relating to this subject which has been preserved, 'El Poema de Cid' — a story whose simplicity and poetic coloring are very striking. It is nothing more, and in this early childhood of Spanish poetry could be nothing more, than a long historical Spanish ballad, without any plot. It belongs, according to all conjecture, to the 12th century, and is much superior to the 'Poema de Alexandro Magno,' which is of nearly equal antiquity, and to the rhymed prayers, legends, and rules of religious orders by the Benedictine monk Gonzalo Berceo. In connection with these ballads should be read those which are taken from the history of the Moors, of which many are found in the 'Historia de los Vandos de los Zegris y Abencerrages,' which is itself a sort of romantic chronicle of the Moorish heroes. There are also a number of Spanish ballads, founded on various popular stories. Little different from the ballad was the song; and perhaps the whole difference, especially in the 13th and 14th centuries, consisted in this, that the song was divided into couplets or small strophes. Subsequently the song became more lyrical; and then arose the *canciones,* properly so called (in 12 lines, similar to the madrigal and the epigram), the kindred species of *villancicos* (stanzas of seven lines), and the poetical paraphrases of known songs and ballads, in which the old songs were interwoven, line by line, with the words unchanged. Spain is distinguished above other countries for having united the greatest part of her ballads and songs in large collections, and thus preserved

Digitized by Google

them to posterity; and the only thing to be regretted is that the date and the author are not generally given. Thus there is a great collection of ballads made in the 16th century, called 'Romancero General' (by Miguel de Madrigal, 1604, and Petro de Flores, 1614), and an older one, 'Cancionero de Romances, etc.' (Antwerp, 1555). The songs are to be found in the 'Cancionero General' of Fernando del Castillo, which belongs to the commencement of the 16th century, and was preceded by a 'Cancionero de Poetas Antiguos,' in the reign of John II. Crowned heads, as Alfonso X. in the 13th century, and the Castilian prince Don Juan Manuel (who died in 1362), had tried their powers in verse and prose; and Manuel's work, 'The Count Lucanor,' a collection of important rules for the lives of princes, remains a beautiful monument of Spanish refinement in the 14th century. The knights themselves, and not, as in other lands, merely monks, had employed themselves in writing chronicles; and the Spanish historical style has hence become more dignified and noble. The pursuits of active life and of literature have been so intimately connected in Spain that its greatest warriors have been also the most intellectually cultivated, and not unfrequently were distinguished poets. Thus we find, in the 15th century, at the court of John II., celebrated as a patron of poetry, the Marquis Henry de Villena, who has left the oldest Spanish Art of Poetry, under the title of 'La Gaya Ciencia' (The Gay Science), and from his knowledge of natural philosophy almost acquired the reputation of a magician; and his yet more celebrated pupil Don Inigo Lopez de Mendoza, Marquis of Santillana, author, among other works, of the 'Doctrinal de Privados' (Manual of Favorites), in which the favorite of John II., Don Alvaro de Luna, who was executed, relates his transgressions, and enjoins moral truths on the turbulent Castilians. Santillana's letter upon the oldest Spanish poetry is very celebrated. Several others — for instance, Juan de Mena (the Spanish Ennius), who died in 1456, author of the allegoric-historical-didactic poem, 'Las Trecentas' (The Three Hundred Stanzas), and Rodriguez del Padron, who in his songs of love exchanged his French idiom for the Castilian — received distinguished favors from the abovementioned king. Attempts were now made in all branches of the art. During the reign of John II. and his celebrated daughter Isabella the dramatic spirit first prevailed. Yet before the time of Juan de la Enzina, who about the end of the 15th century composed pastoral dramas (also the author of the 'Disparates,' which is in the ballad form), the Marquis de Villena encouraged the writing of allegorical plays, and an unknown author produced the celebrated satirical pastoral dialogue 'Mingo Rebulgo.' Then followed the dramatic romance of 'Callistus and Melibœa,' which was also called a tragi-comedy. Some historical and biographical works of importance appeared at the same time. The Chronicles of the poet Perez de Guzman, and of the high-chancellor of Castile, Pedro Lopez de Ayala, have been reprinted in modern times by the Academy of History at Madrid. The 'History of the Count Pedro Nino de Buelna,' by Gutierre Diaz de Games; the 'History of Alvaro de Luna,' by an unknown friend; and the 'Claros Varones' of Fernando de Pulgar, are still largely read.

The second period of Spanish literature begins when the whole monarchy was permanently united under Ferdinand the Catholic. Spain and Italy were brought into connection, by the conquest of Naples, under the great captain (*el gran capitan*) Gonsalvo Fernandez de Cordova; the Inquisition, which, restraining the faith of the Spaniards, left freer room to its fancy, was established, and America discovered. Juan Boscan Almogaver (about the year 1526), nourished by Italian genius, gave Castilian poetry a classic character, by judiciously incorporating in it the excellencies of his Italian models, especially Dante and Petrarch. He confined himself to sonnets and songs; but his friend Garcilaso de la Vega (died 1536) became the author of very popular pastoral poems, to which, in later times, the Portuguese Saa de Miranda and Montemayor gave a more elevated character; the latter, in his pastoral romance 'Diana.' More imbued with the spirit of Horace and Aristotle was the distinguished statesman Diego Hurtado de Mendoza (died 1575), the dreaded minister of Charles V., in Italy, and author of the comic romance 'Lazarillo de Tormes,' a work of decided genius, who composed, upon the model of Sallust and Tacitus, his 'History of the Rebellion in Granada.' He wrote various songs, poetical epistles, and satirical pieces. In odes, in the new style, Fernando de Herrera (died 1597) and Luis de Leon (died 1591) met with much success. These two are considered the greatest lyric poets that Spain has ever produced. The poetry of the latter is chiefly religious, and deeply imbued with mysticism. The witty Castillejo was particularly inimical to this classic Italian school. All attempts to imitate the romantic epic of the Italians in Spanish literature failed; and, in fact, even the later attempts of the Spaniards in the epic have been unsuccessful, if we except the 'Araucana' of Alonzo de Ercilla y Zuñiga (about 1556), which celebrates the conquest of a brave tribe of American Indians.

But the fairest flower of the Spanish Parnassus now opened. We mean its drama. The history of this henceforth embraces nearly all the history of Spanish poetry. The Spanish drama does not recognize the Grecian distinction of comedy and tragedy, but its peculiar divisions are the *comedias divinas* and *comedias humanas*. The former have been divided since Lope de Vega into histories of the lives of the saints (*vidas de santos*); and *autos sacramentales*, plays which were performed upon Corpus Christi days, and had for their object the commemoration of the sacrament. The *comedias humanas* consist of three classes: (1) The heroic, more properly historical in their nature; (2) pieces of the cloak and the sword (*comedias de capa y espada*), drawn from high life, and full of the most complicated intrigue; (3) the *comedias de figuron*, in which vain adventurers or ladies play the chief parts.

In the first half of the 16th century, which begins the third period or the golden age of Spanish literature, after a learned party had attempted, without success, to imitate the Grecian and Roman drama, Torres Naharro appeared, and laid the foundation of Spanish comedy; and Lope de Rueda, called by Cervantes the *great*, followed with pieces in prose. From rude beginnings, among which we must not omit the two tragedies on the history of

Digitized by Google

Ines de Castro, by the Dominican Bermudez, the drama unfolded itself, until the time of Cervantes, the rival of Lope de Vega. Lope de Vega (born 1562) held the highest rank before the appearance of Calderon. In all the abovementioned kinds of Spanish comedy he obtained unbounded applause; and his fertility is astounding. He possessed an inexhaustible power of inventing complicated intrigues, but wanted the highest kind of refinement. A crowd of imitators surrounded him (among whom we may mention Mira de Mescua); but the drama was carried to its highest perfection by the immortal Pedro Calderon de la Barca, who was born in 1660. He was the friend and poet of Philip IV., who had a great fondness for the stage, and himself wrote for it. (See CALDERON.) His example also allured a swarm of feeble imitators; but Solis, Moreto, Molina, Roxas de Castro, and others, should be mentioned with respect.

In one of the finest departments of works of fiction — the romance — Spain has accomplished much. The romance of chivalry early received a peculiar character in the Amadis (probably by Vasco Lobeira, in the 14th century), and flourished for a long time. Its principal productions we may best learn from the judgment passed on them by the curate and barber in 'Don Quixote.' Diego de Mendoza, in his 'Lazarillo de Tormes,' furnished the model of the romances of low life (*del gusto picaresco*) which afterward became so numerous, and of which Don Guzman de Alfarache, by Mattheo Aleman (1599), is one of the most distinguished. A flood of other tales appeared about the same time, among which must be mentioned those of Timoneda and Perez de Montalvan. But the immortal Miguel de Cervantes Saavedra (born in 1547), in his 'Don Quixote,' surpasses all his predecessors and followers. In this Spanish prose found its perfection; and the work makes an epoch in the history of romance — a circumstance which would not have been so much overlooked had it not been customary to consider the knight of La Mancha only as a subject of jest, and to put out of sight the fact that the work affords the most vivid picture of human life. With the addition of the other works of Cervantes the circle of poetic creation in Spain may be said to be completed. With the decline of the state Spanish literature likewise declined. The brothers Argensola, with the title of the Spanish Horaces, many writers of epic, pastoral and lyric poetry, of moderate merit, Espinel, Morales, the Figueroas, Sousa, Virues, Montalvan, rise a little above the general level. The usual appearances of a declining poetry and literature are observed here. The ingenious but affected Louis de Gongora de Argote (after 1600) soon carried a bombastic and strained mode of writing to a great height, and found many followers both in poetry and prose. Spain had likewise at this time, as Italy at an earlier period, her Marinists, or concettists, who largely indulged in metaphors and puns, and a peculiar class called *culturists*, who veiled their want of genius in turgidity and affectation. The cultivation of the prose style during this period was not neglected, particularly in works relating to the history of the nation. The learned theologian Perez de Olivia, who died in 1533, much improved didactic prose, and his scholar and nephew, Ambrosio de Morales, the historiographer of Philip II., followed in his footsteps. Diego de Mendoza wrote, as we have already mentioned, a 'History of the War in Grenada' and Geronymo Zurita 'Anales de la Corona de Aragon.' Antonio de Solis wrote in the 17th century an excellent work on the conquest of Mexico; yet the Jesuit Mariana deserves perhaps to be called the most industrious Spanish historian. Lorenzo and Balthasar Gracian, the latter of whom, by his 'Arte de Ingenio,' had an important influence on the Spanish literature of the 17th century, contributed to the introduction of Gongora's defects into the prose style. In this, no less than in the other periods of Spanish literature, no works of importance are to be found in philosophy or theology.

The fourth period, which begins with the accession of the Bourbon family in 1701, embraces the collapse of the old national literature, the intrusion of foreign elements, and the attempts made to restore the native element, and fuse it with the best elements of modern European civilization.

Foremost among those who introduced the French element into Spanish literature was Ignacio de Luzan, who in his 'Poetica' (1737, folio) applied the rules of French criticism to native literature, and in his own poems tried to substitute brilliancy for genuine poetry. Against the tendency thus inaugurated arose a reactionary movement which had in Garcia de la Huerta one of its best exponents, theoretical as well as practical. A middle course was pursued by the school of Salamanca, which, avoiding the excesses, sought to combine the merits of both parties. The chief of this school of moderate reformers was Melindez Valdes, a veritable poet, whose productions could rouse the enthusiasm of the nation. Iglesias, Noroña, Quintana, Cienfuegos, Ariaza, and Gallego, followed in addition to French, English, and Italian models, at the same time that they preserved a Spanish coloring and Spanish ideas. The liberation of the country from French domination in 1812 had the effect of giving to its literature a more independent and more national character, as is manifest in the poetical works of Xerica, Lista, Martinez de la Rosa, Jose Joaquin de Mora, Angel de Saavedra, and Breton de los Herreros. The number of recent poets is very considerable, and among the most celebrated of them appear the names of Tapia, Maury, Juan Bautista Alonso (Poesias, Madrid, 1834), Jacinto de Quiroga (Poesias, 1834), B. de Campoamor (Poesias, 1840), Espronceda, Serafin Calderon, Zorrilla, Hartzenbusch, Santos Lopez Pelegrin, the satirist Villergas, and Gertrudis Gomez de Avellaneda. The attempts to cultivate the epic muse have been even less successful than in former periods; but the department of romance boasts a few names of some prominence, the chief being that of Saavedra. In dramatic poetry Leandro Fernandez Moratin, a chief exponent of the French classic school, secured for himself a permanent place on the stage, and exercised no small influence on the dramatic art. The subsequent predominance of the romantic school in France had a marked effect on the Spanish drama, though it was opposed by some of the leading writers, as Breton, Saavedra, Hartzenbusch, Trueba, and others. In history Ulloa, Muños, Capmany, Ferreras, Quintana, Navarrete, Clemencin, Torreno,

Digitized by Google

Muños Maldonado, and Marcelino Menendez y Pelayo, have in modern times distinguished themselves as historians. Among the best political orators appear the names of Jovellanos, who also wrote on legislation and political economy, Arguelles, Minaño Marina, Larra, Donoso Cortes, Martinez de la Rosa, and others; while the best works of fiction are from the pens of Humara y Salamanca, Escosura, M de la Rosa, Espronceda, Larra, Villalta, Serafin Calderon, Gertrudis de Avellaneda, Fernan Caballero (Cecilia Böhl von Faber), Armando Palacio Valdés, and Senora Quiroga (born Emilia Pardo Bazan), whose novels have acquired a European reputation. In the latter department of literature the novels of France and England have exercised a considerable influence. In general Spanish literature is rapidly advancing in importance, and promises to occupy a prominent place in the literature of Europe.

In the department of science generally, and particularly in theology and philosophy, comparatively few names have acquired a more than local reputation. The first great philosopher of Spain, Jaime Lucio Balmes (died 1849), belongs to the present century. In political economy Jovellanos, Cabarrus, Canga-Arguelles, and Florez have earned a European reputation. In philology no works of surpassing merit have appeared. Among the most celebrated philologers of modern Spain are the orientalists Casiri and Gayangos. Among the most noteworthy scientific publications of the present century are the 'Enciclopedia Española del siglo XIX.,' and the 'Biblioteca universal de instruccion.' The great work on Spanish literature is that of George Ticknor (Boston, 1849-54; third edition, 1864), which has been translated into Spanish and German. Consult also Bouterwek and Sismondi's works on the same subject, which have been translated both into Spanish and English. Another valuable work is the 'Studien zur Geschichte der spanischen und portugiesischen Nationalliteratur,' by F. Wolf (Berlin, 1859). The (unfinished) work of Amador de los Rios, entitled 'Historia Critica de la Literatura Española,' takes high rank among native works, as does also Pelayo's 'Historia de las Ideas Estéticas in España' (1884-6, 3 vols.). An important undertaking was begun in 1846 and carried on under the auspices of the government. This was the 'Biblioteca de Autores Españoles,' completed in 1880 in 70 volumes, and comprising the works of all the great writers of Spain.

Spanish Art.—*Architecture.*—In spite of the adverse circumstances which the Spanish nation has had all along to contend with, the cultivation of the fine arts has never been entirely neglected. On the contrary, not a few of her monuments of art contrast favorably with those of any other civilized nation. In architecture the edifices of the Roman period for a long time served as models to the Spaniards, and there yet exist many erections throughout Spain to prove this. Of the immense edifices of the Visigoths nothing remains, while on all sides proofs are to be met with of the architectural grandeur of the Moorish period (711-1492). Among the extant monuments is the magnificent palace of the Moorish kings at Granada, the celebrated Alhambra. The interior of this immense building was of almost unexampled magnificence. It was in the purely Oriental style, with its colonnaded walks, gardens with sparkling fountains, baths, splendid saloons, above which hung the rich roof, gilded and starred like a heaven. "The architecture of the Arabs," says Owen Jones, "is essentially religious, and the offspring of the Koran, as Gothic architecture is of the Bible." The Romanesque architecture, which insensibly extended southward with the Christian kingdoms, offers few edifices of any importance. An example of this style is seen in the cathedral of Tarragona. On the other hand Spain is particularly rich in Gothic structures, which mostly date from the latter part of the 14th century. One of the oldest and grandest of these is the cathedral of Toledo, begun in 1227; while the cathedrals of Barcelona and Seville date from the end of the period. The decline of Spanish architecture dates from the 16th century, when Italian models were followed. Among the more distinguished of later architects may be mentioned Juan de Toledo and Juan de Herrera, who designed the Escurial; Filippo Ivara (1685-1735), and more recently Mariano Lopez Aguado, Custodio Teodoro Moreno, Inclan Valdes, and Annibal Alvarez.

Sculpture and Painting.—In sculpture Spain is particularly poor, and not till the 19th century do we meet with any sculptors of note. Jose Alvarez, Antonio Sola, Medina, Ponzano, Francisco Perez del Valle, and Fr. Elias are among the more illustrious sculptors. In painting, though a few names are met with earlier than the 16th century, it is only then that anything like a native school appears. The school which had most influence on Spanish painting was the Venetian, more particularly as represented by Titian; and the two famous schools of the 17th century, those of Madrid and Seville, exhibit this influence in a marked degree. To the school of Seville belong Francisco Pacheco (born in 1571); Juan de la Roelas (born in 1558); the two Herreras; the three Castillos, of whom the most celebrated was Juan, the master of Murillo; Francisco Zurbaran (1598-1662), who first fixed the style of this school; Velasquez, who, later, as the court painter, exercised a powerful influence on the Madrid school; Alonso Cano (1610-67); Pedro de Moya (1610-66), a pupil of Van Dyck; and the greatest of all, Murillo, after whose death in 1682 the Seville school lost all its importance. The school of Madrid produced Luis Tristan (born in 1586); the two Carduchos, who were Florentines by birth; Juan de Paraja and Mazo Martinez, pupils of Velasquez; Antonio Pereda (1590-1669), who in his coloring excelled Murillo himself; Juan Careno de Miranda (born in 1614); Fr. Rizi; Juan Antonio Escalante (1630-70); Claudio, Coello, etc. The common character of these two schools is an intelligent naturalism, sometimes reaching a very exalted degree of beauty, which is aided by bold design and composition, free from either caprice or arbitrariness, and a coloring somewhat too sombre in the shadows, but remarkable for its lustre and transparency, while its great softness places it in a middle position between the coloring of the Venetian school and that of the Neapolitan school. Painting took another direction in the school of Valencia, which experienced still more strongly the influence of Italy. The most celebrated masters of this school were Francisco Ribalta (1551-1628) and his pupils Pedro Or-

Digitized by Google

vente (born in 1550) and Jose Ribera, called Spagnoletto (1588–1656), who afterward became the chief of the school of Naples. Spanish painting after this rapidly sunk to decay, but has experienced a partial revival through the not very healthy influence of the classicism of the French school. Among the more prominent of recent artists may be mentioned Vicente Lopez y Portana; Jose and Frederico Madrazo y Agudo; Juan Antonio and Carlos Luis Riber Esquirel, a portrait and historical painter; Genaro Perez Vilamil, a remarkable landscape-painter (died in 1854); Pedro Kuntz, who excels in perspective; etc. The Exposition Universelle of 1867 contained a number of important works by Spanish painters of good promise. But the one Spanish artist who in modern times has attained a world-wide reputation was Fortuny (born 1839, died 1874), a brilliant and original painter.

Spalding, spâl'dĭng, **Frederick Putnam,** American civil engineer: b. Wysox, Pa., 7 April 1857. He was graduated from the School of Civil Engineering of Lehigh University in 1880, and after practising for several years, was instructor in the University 1886–8; assistant professor of civil engineering at Cornell, 1891–8, and has held a similar professorship in the University of Missouri since 1900. His publications include ‘Notes on Hydraulic Cement’ (1893); ‘Text Book on Roads and Pavements’ (1894); ‘Hydraulic Cement’ (1897).

Spalding, John Franklin, American Protestant Episcopal bishop: b. Belgrade, Maine, 25 Aug. 1828; d. Erie, Pa., 9 March 1902. He was graduated from Bowdoin College in 1853, from the General Theological Seminary, New York, in 1857, and was ordained to the priesthood in 1858. He had charge of various parishes in Maine and Rhode Island in 1859–62, and was rector of Saint Paul's Church, Erie, Pa., in 1862–73. In the year last named was consecrated first bishop of the missionary diocese of Colorado. He was an able and forceful organizer, and an active promoter of advancement in education. His publications include: ‘Modern Infidelity’ (1862); ‘The Higher Education of Women’ (1886); ‘The Threefold Ministry of Christ’ (1889); ‘Jesus Christ the Proof of Christianity’ (1890); etc.

Spalding, John Lancaster, American Roman Catholic prelate: b. Lebanon, Ky., 2 June 1840. His preliminary studies were pursued at Saint Mary's, Kentucky, and subsequently he attended Mount Saint Mary's, Emmitsburg, and Mount Saint Mary's, Cincinnati, afterward entering the American College at Louvain, Belgium, and being there ordained to the priesthood in 1863. He then devoted a year to special studies in Rome, Italy, and having returned to America, was assigned to duty in the Cathedral of Louisville, Ky. In 1866 he was accorded the honor of preaching at the Second Plenary Council of Baltimore, a rare privilege for one so young, and despite many obstacles he founded in Louisville a parish for negroes. Requested to be the biographer of his illustrious uncle, Archbishop Spalding, who died in 1872, Father Spalding repaired to New York for the purpose and upon completing his labor of love, became assistant to Father Donnelly at Saint Michael's Church, New York, where he soon established a reputation as a preacher of extraordinary ability, being called thence to the episcopal dignity and consecrated first bishop of Peoria, Ill., in Saint Patrick's Cathedral, New York, 1 May 1877. He was associated with Archbishop Ireland in founding the Catholic Colonization Society, and in him higher Catholic education has one of its most ardent promoters. Long before the Catholic university at Washington assumed material proportions, it had been conceived in the mind of Bishop Spalding, who was tireless in planning for its foundation; and the elaborate Catholic educational exhibit at the World's Columbian Exposition in Chicago in 1893, of which he was president, was prepared largely at his instigation. President Roosevelt appointed him one of the board of arbitration for the settlement of the great anthracite coal strike in 1902. His writings are among the most scholarly contributions to American literature, ‘Education and the Higher Life,’ ‘Things of the Mind,’ ‘Thoughts and Theories of Life and Education,’ ‘Opportunity and Other Essays,’ ‘Religion, Agnosticism and Education,’ ‘Socialism and Labor and Other Arguments,’ and ‘Religion and Art, and Other Essays’ (1905), being some of the most notable of his works. Bishop Spalding is also the author of poems. Columbia University conferred upon him the degree of LL.D. in June 1902. Bishop Spalding was twice stricken with paralysis and failing to recover full vigor resigned his charge 10 Sept. 1908.

Spallanzani, späl-län-dzä'nē, **Lazzaro,** Italian naturalist: b. Scandiano, 12 Jan. 1729; d. 12 Feb. 1799. He studied at Reggio and afterward at Bologna, under Laura Bassi, the celebrated woman professor of physics in that place. In 1754 he was appointed teacher of logic, metaphysics, and Greek at Reggio. In 1760 he accepted a professorship at Modena, and on the reconstruction of the University of Pavia, in 1768, he was appointed to the chair of natural history there, and thenceforth devoted himself to experimental researches, and published in Italian various works on physiology, which made his name known through Europe. Among the subjects which engaged his attention were the phenomena of generation, the functions of respiration, digestion, and the circulation of the blood. In opposition to the opinion of Buffon and Needham, he proved that the Infusoria are really endowed with animal life, and not merely organic molecules. Among his writings may be cited ‘Experiments on Animal Reproduction’; on ‘Infusory Animalcules’; on the ‘Phenomena of Circulation’; on ‘Animal and Vegetable Physics’; ‘Transpiration of Plants.’

Span, a measure of length, being the distance between the tips of the thumb and little finger when the fingers are expanded to their fullest extent. This space averages about 9 inches, which accordingly is the fixed measure given to the span.

Span-worm. See Measuring-worm.

Spandau, spän'dow, Germany, in Prussia, a fortified town of Brandenburg, at the junction of the Spree and Havel, 12 miles north of Potsdam. In the Julius tower of the Citadel is deposited the reserve war fund of the empire

Digitized by Google

— $30,000,000. Here are large foundries and factories for all fire-arms, guns, and all munitions of war. Also a garrison of several thousand men. The principal buildings are churches, schools — including military schools for the different arms — artillery-construction bureau, factories for gunpowder, military and city hospital, etc., the fisheries and timber trade are important, also ship-building, horse and pigeon propagation for military purposes, etc. The town was often the residence of the first electors of the House of Hohenzollern, and subsequently passed into Swedish hands — till 1634. In 1806, the French took possession, and in 1813 was surrendered to the combined Prussian and Russian forces.

Span'drel, or **Spandril,** in architecture, an irregular space on a wall bounded by the outer curve of an arch, and two lines meeting at right angles, the one drawn perpendicularly from the springing of the arch, and the other horizontally from the apex, or by the outer curves of two contiguous arches and a horizontal line above them, or by similar curves of contiguous arches and the line of a larger arch enclosing the other two.

Spangenberg, spăng'ĕn-bĕrg, **Augustus Gottlieb,** German religionist: b. Klettenberg, Prussia, 15 July 1704; d. Berthelsdorf, Saxony, 18 Sept. 1792. He studied at Jena, abandoned law for theology, became a lecturer at the university and occasionally preached, in 1732 was made adjunct of the theological faculty at Halle, and in 1733 was dismissed because of his doctrinal views. At once he entered the Moravian Church at Herrnhut, and labored in Germany, America, the West Indies, and England, where he established the Society for the Furtherance of the Gospel among the Heathen. After his consecration as bishop in 1744 he was at the head of the Moravian Church in America until his return to Europe in 1762. On his arrival in Germany he participated in framing the new constitution of the Church, of whose governing board he was the chief member. Among his works are: 'Idea Fidei Fratrum' (1782) (Eng. trans. by La Trole, 'Exposition of Christian Doctrine' 1784); and 'Leben des Grafen von Zinzendorf' (1775) (abridged Eng. trans. by Jackson 1838). He also wrote some well known hymns, such as 'Heil'ge Einfalt, Gnadenwunder' (Hymnal No. 432) and 'Die Kirche Christi, die Er geweiht' (Hymnal 612). The chief biographies of him are by Risler (1794) and Ledderhose (1846; Eng. trans. 1855).

Spang'ler, Henry Thomas, American college president: b. Myerstown, Pa., 14 Nov. 1853. He was graduated from Ursinus College, Pa., in 1873, and afterward studied at Heidelberg. He was licensed a minister in the German Reformed Church in 1875, held a pastorate 1877–90, and after being professor of psychology in Ursinus College (1891–3), became its president in 1893.

Spaniel, a small shaggy race of dogs, deriving its name from Spain, whence it originally came to Great Britain; and now generally divided into the two groups — sporting and toy spaniels. The common «field» spaniel is the type of the group, and two breeds of this variety, «springer» and «cocker,» are distinguished. The former is a heavy dog used for beating game in thick coverts. The spaniel has the hair very long in some parts; it is generally white, with large brown, liver-colored, or black spots, of irregular shape and size; the nose is sometimes cleft; the ears are very long and pendulous, and covered with long hair. The tail is feathery and waves from side to side when the dog runs. Two famous breeds of springer spaniels are the black Sussex and the larger Clumber breed is also well known. The cocker, whose name recalls its former use in English woodcock shooting, is much smaller than the field spaniel. The best-known breeds of the latter form are the English, Welsh, and Devonshire varieties. The smaller, King (or Prince) Charles spaniel, is a small variety of the spaniel, used as a lap-dog. It is sometimes found entirely black, and receives its name from the liking of Charles II. for this variety. The Blenheim breed is of smaller size than the King Charles variety, and is bred merely as a pet. Its hair is long and silky, and does not curl; the ears are long, and provided with the same silky hair; the legs are covered with this hair to the toes; and the tail possesses a broad hairy fringe. The water-spaniels are dogs of moderate size, and average about 22 inches in height at the shoulders, and the ears are very long and pendulous. The Japanese pug-nosed spaniel, Maltese, and other toy-breeds may be added to this list. See DOG.

Spanish-American Literature. See LATIN-AMERICAN LITERATURE.

Spanish-American War. See UNITED STATES, SPANISH-AMERICAN WAR.

Spanish-American War, The Naval and Military Order of, an association organized in New York 2 Feb. 1899. Its objects are to cherish the memories and associations of the war. There are state branch associations in Pennsylvania, Massachusetts and Illinois. The total membership in 1903 was 1,100.

Spanish Broom, a leguminous papilionaceous shrub (*Spartium junceum*), a «switch plant,» characterized by bunches of rod-like branches, terete, polished and green. The branches are without foliage, serving as organs of assimilation; or they may have small lancet-shaped leaves, scantily developed and quickly falling. The Spanish broom is native to the Mediterranean shores, where it grows in masses, as may be seen on Gibraltar, on dry and rocky ground. It has been naturalized in tropical America, and cultivated for the terminal racemes of large pea-like flowers. These are an inch long, golden yellow, and very fragrant, with the odor of acacia, and are a favorite food of bees. They also yield a yellow dye. The tough twigs are used as food for goats, and produce a coarse fibre; the seeds, from linear pubescent pods, are diuretic and tonic, and in larger doses, emetic and cathartic.

Spanish Era. See EPOCH.

Spanish-fly. See BLISTER-BEETLE.

Spanish Fort, a part of the defenses of the city of Mobile, Ala., during the Civil War; taken by the Federals 8 April 1865. It consisted of a system of fortifications, rather than a single fort. On 27 March it was invested by Union troops, A. J. Smith's corps, on the right, and Granger's on the left; a bombardment was be-

Digitized by Google

gun 4 April, in which the gunboats on the river joined, and a naval battery on shore rendered service. The Federals intended to assault the defenses on 9 April; but on the 8th Gen. Carr found that it was possible to place a battery on a wooded crest commanding the fort and that evening his troops gained the crest, captured 300 yards of the works and, getting their battery into position, compelled the Confederates to evacuate. Consult: 'Battles and Leaders of the Civil War,' Vol. IV.

Spanish Fowls. See POULTRY.

Spanish Language, Literature, and Art. See SPAIN, LANGUAGE, LITERATURE, AND ART OF.

Spanish Mackerel, a mackerel (*Scomberomorus maculatus*), with the body more compressed than that of the common mackerel and the head short and conical. It reaches a length of about 30 inches, and is a handsome fish marked on the sides with round golden bronze spots which distinguish it at once from any other fish occurring in our waters. This mackerel is properly a tropical species, but during the summer migrates northward along the Atlantic coast, occasionally reaching even Cape Cod. It is one of the most graceful and active of fishes, and swims at the surface in schools in pursuit of menhaden, silversides and other smaller fishes, which constitute its chief diet. The species is very prolific, each female producing from 300,000 to 1,000,000 of the small buoyant eggs which develop rapidly and may hatch within a single day. In Chesapeake Bay, which is an important spawning ground, the breeding season is June. Besides being a favorite game-fish in the south, the Spanish mackerel is commercially of considerable importance, being excellent on the table, but scarcely known before the introduction of the pound-net into our fisheries. Many are taken in these nets about Sandy Hook, but the most important fisheries are in Chesapeake Bay where gill-nets are also employed largely in their capture. In 1901 about 520,000 pounds, valued at $45,000, were caught in the latter region, and 38,928 pounds, valued at $5,729, in New Jersey. The sierra (*S. regalis*) and the silver cero or kingfish (*S. cavalla*) are related species found in the West Indies and along the coast of the South Atlantic States.

Spanish Main, a name formerly given to the coasts of the Spanish colonies bordering on the Caribbean Sea, and often transferred to the sea itself. In the latter sense it occurs frequently in connection with the buccaneers. See BUCCANEERS.

Spanish Moss, an epiphytic, pendulous plant (*Tillandsia usneoides*) of the pineapple family, which is widely distributed throughout tropical America. The softly-haired seeds are carried by the wind, to the rough bark of tree-branches, where they lodge, and germinate. The stems are very slender, gray and scurfy, sometimes several feet long, bear scattered leaves which are narrowly linear, and have in their axils solitary, regular and perfect 3-merous flowers, which are yellow-petaled but inconspicuous. The plants are silvery gray in tone, which accounts for their common name of old man's beard; and they drape the forests extensively and mournfully, in contrast with the evergreen of pines and live oaks, as far north as the Carolina coast and in southern California. It is used after drying as packing for articles in boxes, stuffing for cheap mattresses, etc. See FIBRE.

Spanish Peaks, two isolated mountains which form prominent landmarks in southern Colorado, near the Mexican border. The summit of the higher peak is 13,623 feet above sea-level. It is partly composed of volcanic rocks. The other mountain is 12,720 feet high.

Spanish Succession, War of the. See SUCCESSION WARS.

Spanish Town, or **Santiago de la Vega,** town of Jamaica, 10 miles west of Kingston. It is connected with Kingston by railroad, and is the second town in importance on the island. It was formerly the capital, but the seat of government was moved to Kingston in 1872. It is ill built and unhealthy. Pop. 6,000.

Spanish War Veterans, a society organized by men who took part in the Spanish-American War. The object of the society, which was incorporated 28 Nov. 1899, is to keep alive the memories of the war with Spain in a patriotic American sense, and not with the view of nursing any feeling of international enmity, to promote the best interests of those who took part in the war in the service of the United States, and to encourage universal liberty and equal rights and justice. Although the number of killed and wounded in the Spanish War was not large, as compared with other wars in which the United States has been engaged, the conditions of climate and season during the Cuban campaign were such as to do permanent injury to thousands of veterans who were not wounded in battle, and many suffered serious detriment to health who never passed beyond the Southern camps. The veterans of this conflict, therefore, have strong reasons for being mutually helpful, and for keeping true to that spirit of comradeship which has had such a marked influence in upholding and advancing the interests of civil war veterans. The society has grown rapidly in numbers and now includes the larger part of the volunteer veterans throughout the United States. The officers are Harold C. Megrew, Indianapolis, Commander-in-chief; Champe S. Andrews, New York, Senior Vice-Commander-in-chief; Lucien F. Burpee, Waterbury, Conn.; Junior Vice-Commander-in-chief; L. A. Dyer, Washington, D. C., Adjutant-general; Robert A. Brunner, Rutherford, N. J., Quartermaster-general; Frederick C. Kuehnie, New York, Inspector-general; I. N. Kinney, Bay City, Mich., Judge-advocate-general; Frank Hendley, Cincinnati, Ohio, surgeon-general; Rev. W. H. I. Reaney, U. S. N., Chaplain-in-chief. The Council of Administration consists of Henry F. Warren, Bay City, Mich.; W. T. Durbin, Indianapolis, Ind.; C. C. Mattes, Scranton, Pa.; Fred W. Averill, New Haven, Conn.; Henry A. F. Young, Brooklyn, N. Y.; James W. Carver, Auburn, Me.; J. L. King, Washington, D. C.; George W. Skipwith, Richmond, Va.; Michael J. Murphy, Boston, Mass.; Charles Leimbach, Brooklyn, N. Y.; John T. Hilton, Paterson, N. J.; C. J. Heinz, Dayton, O.

Spanish War Veterans, National Auxiliary of, an association composed of the mothers.

Digitized by Google

wives, sisters and daughters of members of the Society of Spanish War Veterans, also of other women, such as nurses, who rendered special service during the war in camp or hospital, or otherwise.

Spar, a general name in mineralogy for a cleavable mineral which is not an ore. Thus we have feldspar, comprising both orthoclase and plagioclase; calcspar or cleavable calcite, with its transparent variety iceland spar; fluor spar, or fluorite; satin spar, or fibrous gypsum; tabular spar, or Wollastonite, and heavy spar, or barite. The term is of German origin.

Spar'idæ, a large family of carnivorous shore-fishes, the porgies, of tropical seas, especially abundant in the Mediterranean, Red Sea and West Indian waters. None are of great size; the body is oblong, likely to be elevated, covered with large adherent scales and ornamental colors; the mouth is filled with strong teeth, in which the incisors are prominent. Most of them are excellent food, and many are gamy. Jordan says that about 11 genera and 100 species are counted in the family, about half of which occur in North American waters. These include the scup, porgies, sheepshead and related fishes. Consult: Goode, 'American Fishes' (New York 1888); Jordan and Evermann, 'Fishes of North and Middle America' (Washington 1898).

Sparks, Edwin Erle, American historical writer: b. Licking County, Ohio, 1860. He was graduated from Ohio State University in 1884 and from the University of Chicago in 1900. He was instructor at Ohio State University 1884–5; professor at Pennsylvania State College 1890–5; lecturer before the American Society of University Extension 1893–5; and has been professor of American history at the University of Chicago since 1895. He has published: 'Expansion of the American People' (1899); 'The Men Who Made the Nation' (1900); 'Formative Incidents in American Diplomacy' (1902); 'The United States' in the Story of the Nations series (1903).

Sparks, Jared, American scholar and historian: b. Willington, Tolland County, Conn., 10 May 1789; d. Cambridge, Mass., 14 March 1866. He was graduated from Harvard in 1815, studied theology with Dr. Nathaniel Thayer from May 1817 to March 1818, was editor of the 'North American Review,' then begun in Boston, and in 1818 entered the Unitarian ministry. On May 1819 he was ordained pastor of the Unitarian congregation at Baltimore, Md., Dr. W. E. Channing (q.v.) preaching on that occasion the well-known discourse on 'Unitarian Christianity.' Sparks did much in Baltimore to promote the growth of the Unitarian faith, instituting there a Unitarian book society, and editing the 'Unitarian Miscellany,' a monthly periodical. He resigned in 1823, and from 1823 to 1830 was again editor of the 'North American,' in which he acquired a three-quarter interest. After some periodical contributions to the economic history of the South, and to Mexican and South American history, he published in 1828 a 'Life of Ledyard,' the American traveler. In the preparation of this work he first undertook that method of travel and research among original sources in which he was the pioneer in the United States, and which he afterward so worthily applied to the study of American history. After long investigation, including a very wide correspondence, and a voyage to Europe for the examination of records in the public offices of London and Paris, he published the well-known 'Writings of George Washington, with a Life of the Author, Notes and Illustrations' (1834–7), which remained the standard until to an extent superseded by W. C. Ford's edition (1889–93). Sparks used the copies of Washington's letters as found in the latter's letter-book. The discrepancies found to exist between the copies and the originals as preserved refuted the charges at first made to the effect that Sparks had wilfully altered the letters. Sparks' method of editing in general has, however, been discarded. He printed only what he believed of importance, omitting and altering passages as he saw fit. This was largely due to the idea of editorial discretion then observed, and should not be made occasion for disparagement. Whatever be said of his methods in editing text, Sparks was a really distinguished historical scholar, and maintained almost invariably as high a level of excellence as was then possible to the historical editor. He also prepared 'The Works of Benjamin Franklin' (1836–40); 'The Library of American Biography' (1st series 1834–8; 2d 1844–8), himself writing 7 of the 60 lives; and 'Correspondence of the American Revolution' (1854). He also wrote 'Remarks on American History' (1837). He was professor of history at Harvard in 1839–49, and president in 1849–53. The standard biography is H. B. Adams' 'Life and Writings of Jared Sparks' (1893); there is also one by Ellis (1869).

Sparrow, the familiar name of many small birds of the finch family (*Fringillidæ*), applied loosely to the representatives of a large and varied assemblage of genera. Generally speaking, sparrows are moderately sized members of the family which live mostly on or near the ground, whose bills are neither especially short and stout nor angulated in the gape, and which have the sexes similarly colored. About 10 genera and 40 species called sparrows belong to the North American faunas of which the following may be mentioned. The white-crowned sparrow (*Zonotrichia leucophrys*) is about 7 inches long, the body stout, and the tail rather long and moderately rounded; the chin, throat, and breast are nearly uniform ashy; the head above black; median and superciliary stripe pure white; a narrow black line through and behind the eyes; back and wing-coverts dark reddish brown with paler margins; quills and tail darker; wings with two white bands; whitish below; bill reddish orange tipped with brown. It is found from the Atlantic to the Rocky Mountains and from Labrador to Texas, breeding to the north and in the Rocky Mountains. The notes are mellow and sweet, six or seven in number, the first loud and clear, and thence becoming fainter and more plaintive; eggs light green with brownish mottlings at the larger end; the nest is on the ground or among moss, and the eggs are laid in Labrador from the 1st to the end of June. The flight is low, swift; the food consists of seeds, berries, and insects; the migrations are performed mostly by day. It spends its summers in northern Canada and Alaska. The white-throated sparrow or peabody

Digitized by Google

bird (*Z. albicollis*) has the chin abruptly white; superciliary stripe broad, yellow anteriorly and white behind; median head-stripe white, with a black one on each side, and a broad black streak behind the eye; edge of wing and axillaries yellow; two narrow white bands across wing coverts. It is found in the eastern United States and westward to the Missouri, appearing in the Southern States in November and departing in March to the North. It breeds from the northern tier of States northward, and its nest, eggs and song resemble those of the last. This species is very active among hedges and thickets, and is found in flocks with the white-crowned sparrow, than which it is generally more plentiful. These, with two or three additional western species of *Zonotrichia*, are among the largest and most handsome of our sparrows.

The genus *Spizella*, which differs from the last in its smaller size and longer forked tail, contains three well known northern species and as many more confined to the western and southern United States. The field sparrow (*S. pusilla*) is about 5½ inches long; the bill is reddish; ear coverts, crown, and back rufous, the last with blackish streaks; sides of head and neck, and stripe over eyes, ashy; white below, tinged with yellow anteriorly; quills and tail faintly edged with white, and two bands of the same across wing coverts; rump yellowish brown. It is found in eastern North America as far as the Missouri, remaining in the Southern States during winter, going north in March, and arriving in New England toward the last of April. The song is pleasing, resembling the trill of a young canary. It is sociable and peaceful, and very prolific, sometimes raising three broods a year. The nest is of grasses and placed on or near the ground; the eggs usually 4 or 5, whitish thickly speckled with reddish brown. It frequents fields and fence rows, and flocks when not breeding. The chipping-sparrow (q.v.) and tree-sparrow belong here. The genus *Passerella* is remarkable for the elongation of the lateral toes and the large size of the claws, adapting these birds for scratching on the ground. The fox-colored sparrow (*P. iliaca*), with its several varieties, is our only representative. It is 7 inches long, the back is rust brown, margined with ashy, lighter on the head, tail, and wing coverts, rufous on the last two; white below, streaked with light brownish red on breast and sides of neck, rufous patch on cheeks. It is found as far west as the Mississippi, preferring the Northern States and going south in winter. It is seen in small flocks in the underwood and along brier-skirted fences and streams. It breeds in British America. The flight is slow, rapid and undulating; the song clear, full, sweet, and prolonged with many repetitions. The nest is made on the ground or in bushes.

Other important genera are *Ammodramus*, with 11 species, including the savanna sparrow (*A. sandwichensis*), the yellow-winged grasshopper sparrow (*A. passerinus*), the sharp-tailed sparrow (*A. caudacutus*), and the sea-side sparrow (*A. maritimus*), the last two inhabitants of salt marshes, *Melospiza*, including the song sparrows (q.v.); *Poöcætes*, with the vesper sparrow or bay-winged bunting (*P. gramineus*); and others less well-known. The sparrows of Europe are few in number and belong to the genus *Passer*. Besides the house sparrow (q.v.), the European tree-sparrow (*P. montanus*) has been introduced into this country. There is also an American bird of the same name, also called Canada sparrow (*Spizella monticola*), which much resembles the chipping-sparrow, but has a distinct dark spot on the breast and conspicuous white wing-bars. It is a northern bird, but in the winter is abundant in the United States, flocking in fields and shrubbery.

Consult: Ridgway, 'Birds of North and Middle America,' Part I. (Washington 1902); and general works on ornithology. For the «English» sparrow, see HOUSE-SPARROW.

Sparrow-hawk, a small falcon (*Falco sparverius*), common throughout North America and practically cosmopolitan, since scarcely distinguishable species inhabit all quarters of the globe. It is 11 to 12 inches long, and the adult male has the back tawny; wings bluish and black; seven black blotches about the head; tail chestnut, with a broad black band and a narrow terminal one of white; below white or tawny. The female is more streaky, has the tail tawny with numerous narrow darker bars; back and wing-coverts rusty, barred with black. These birds are true falcons (see FALCONRY), and admirably bold and active. Not unfrequently the sparrow-hawk may be seen to attack other and larger birds of prey, its courage extending even to a reckless degree, while it is also shy and wary. It feeds largely on mice, which it catches with great skill, and also sometimes seizes young chickens, but its depredations in that direction are of little consequence. It makes its nest in hollows of trees, the deserted hole of a large woodpecker, or sometimes an abandoned crow's-nest.

Sparrow-owl, one of the diminutive, brown-streaked owls of the genus *Nyctale*, of which the saw-whet (q.v.) is a familiar example. The name belongs primarily to Tengmalm's owl of Northern Europe, of which Richardson's owl (*N. richardsoni*) of Canada and Alaska is an American variety. It is bold and strong, and feeds mainly on small birds.

Sparta, spär'tạ, a celebrated city of ancient Greece, the capital of Laconia and of the Spartan state, lay on the west bank of the river Eurotas, and embraced a circuit of six miles. Sparta was irregularly built, and from this circumstance it is supposed to have got its name, signifying «scattered.» It consisted of five separate quarters, which were not completely surrounded by walls till the time of the Romans. It was the boast of Sparta that her men were her walls. Among other remarkable objects enumerated by Pausanias are the following: the market-place, containing the public buildings, in which the council of the elders held their meetings, and the principal ornament of which was the Persice, a celebrated colonnade, built from the spoils taken from the Persians; its roof was supported by statues of Persians; the theatre the remains of which constitute the principal ruins of Sparta; the *chorus*, or place in which the ephebi executed their dances, adorned with statues of Apollo, Artemis, and Leto; the Leschai, or halls in which the popular assemblies were held, and of which there were two — the Lesche of the Crotanes, near the tombs of the Agides, and the

Digitized by Google

Lesche Pœcile; the Temple of Athene Poliouchos or Chalkioikos, as the goddess was commonly called, from the bronze ornaments of her temple, on a steep hill, to which the Spartans gave the name of the Acropolis; etc. Sparta was the name of the city during the period of its historical celebrity. Lacedæmon is found in Homer as the name both of the city and the territory, but it afterward dropped out of use, and does not appear to have been revived till several centuries after Christ. LACONIA, the district in which Sparta was situated, was the southeastern division of the Peloponnesus, bounded on the west by Messenia, from which it was separated by the chain of Taygetus, on the north by Arcadia and Argolis and on the east and south by the sea. The principal towns in Laconia besides Sparta were Amyclæ and Pharis, both situated like Sparta on the west bank of the Eurotas, a little lower down.

The Spartans were the descendants of the Dorians who invaded the Peloponnesus about 80 years after the siege of Troy, and from an early period they followed a set of rigorous institutions aimed at forming them into a purely warlike nation. These institutions they themselves ascribed to Lycurgus, who, if he was really a historical character, must have lived not later than the 9th century. Shortly after their settlement in the Peloponnesus it is probable that the Spartans extended their sway over all the territory of Laconia, the inhabitants of which they reduced partly to the condition of Helots and partly to that of Periœci. The former were completely enslaved, bound to the land which they had to till for their masters, and required to serve the state in war. The latter were free, possessing land of their own, and carrying on trade and practising the arts, both of which pursuits were forbidden to Spartans. The next great wars of Sparta are usually regarded as the direct consequence of their new institutions. They were waged with the Messenians in the 8th and 7th centuries B.C., and resulted in 668 B.C., in the complete subjugation of the Messenians, who were either compelled to leave their country or reduced to the condition of Helots. Wars were also carried on against their northern neighbors, the Arcadians and the Argives, against both of whom they were successful, and before the close of the 6th century B.C., they not only stood at the head of the states of the Peloponnesus, but were even recognized as the leading people in all Greece. Early in the following century began the Persian wars, in which Sparta played a conspicuous part, but the details of this epoch down to the conclusion of the Peloponnesian war in 404 B.C. belong to the common history of Greece, to which the reader is accordingly referred. It is enough to state here that the events of the wars with Persia led to Sparta being supplanted by Athens as the leading state in Greece; that there hence arose a jealousy between the two cities which ultimately brought on a war, in which the one half of Greece was divided against the other, and that this war, the Peloponnesian, ended in the ascendency of Sparta and the entire humiliation of her rival. The rivalry of the Spartan general Lysander and the king Pausanias soon after produced a revolution, which delivered the Athenians from the Spartan yoke (403). Soon after the Spartans became involved in a war with Persia, by joining Cyrus the Younger in his rebellion against his brother Artaxerxes Mnemon (401). The war was continued even after the failure of the enterprise of Cyrus, and the Persian throne was shaken by the victories of Agesilaus; but Athens, Thebes, Corinth, and some of the Peloponnesian states, took this opportunity to declare war against the Lacedæmonians. The latter defeated the Thebans at Coronea (394); but, on the other hand, the Athenian commander Conon gained a victory over the Spartan fleet at Cnidus. This war, known as the Bœotian or Corinthian war, lasted eight years, and increased the reputation and power of Athens. To break the alliance of Athens with Persia, Sparta, in 387 B.C., concluded with the latter power the peace known by the name of Antalcidas; and the designs of Sparta became apparent when she occupied, without provocation, the city of Thebes, and introduced an aristocratical constitution there. Pelopidas delivered Thebes, and the celebrated Theban war (378–363) followed, in which Sparta was much enfeebled. During the following century Sparta steadily declined, although one or two isolated attempts were made to restore its former greatness. The principal of these was made by Cleomenes (236–222), but his endeavors failed, because there were then scarcely 700 of Spartan descent, and the majority of these were in a state of beggary. With the rest of Greece Sparta latterly passed under the dominion of the Romans in 146 B.C.

The Spartans differed from the other Greeks in manners, customs, and constitution. Their kings (two of whom always reigned at once) ruled only through the popular will, acting as umpires in disputes, and commanding the army. The Spartans proper, that is, the descendants of the Dorians, occupying themselves with war and the chase, left all ordinary labor to the Helots, while the class known as Periœci engaged in commerce, and manufactures.

Sparta, Wis., city, capital of Monroe County; on the La Crosse River, and on the Chicago, Milwaukee & Saint Paul and the Chicago & Northwestern R.R.'s; about 23 miles northeast of La Crosse. It is a favorite summer resort. It is in an agricultural and fruit-growing region. It has flour and feed mills, machine shops, paper mills, and cigar factories. The educational institutions are a high school, public and parish elementary schools, and a public library. The city contains several churches and the State School for Dependent Children, and the Hospital for the Insane is a short distance north. The three banks have a combined capital of $100,000. Sparta was first settled in 1851, was incorporated as a village in 1857, and as a city in 1883. It is governed by a mayor and a council of eight, elected biennially. Pop. (1910) 3,609.

Spartacus, spär'ta-kŭs, **Roman gladiator:** b. Thrace: d. Lucania 71 B.C. He had been captured by the Romans, sold as a slave, and trained as a gladiator at Capua. Here he headed a fight for freedom and succeeded, with 70 comrades, in reaching the crater of Vesuvius, when he was soon joined by other fugitives. His force soon grew to large proportions and Spartacus gained several battles. He now pro-

Digitized by Google

claimed the abolition of slavery, and, being joined by the slaves of the South, passed Rome with a victorious army of about 100,000 men and advanced into the region of the Po. His plan was to lead his army out of Italy and disband it, so that the freed slaves might return to their homes. Despite dissensions and disaffections which arose, he now successively met and defeated the two consuls sent against him (72 B.C.). But the slaves, flushed with success, refused to follow their leader out of Italy and demanded to be led against Rome. Spartacus therefore conducted them into winter quarters at Thurii, where Licinius Crassus was sent against him. Having defeated two legions of that general's command, he broke through the obstacles which Crassus had interposed and marched toward Rome. He was overtaken, however, and owing to the dissensions in his army was defeated. Attempting to cross into Sicily, he was betrayed by Sicilian pirates and a portion of his army was captured by Crassus. With the remainder Spartacus effected new victories, but in a decisive battle with Crassus on the river Silarus his army was annihilated, Spartacus himself being slain.

Spartanburg, spär'tạn-bėrg, S. C., city, county-seat, Spartanburg County; on the Charleston & W. C., the Southern, and the Glenn Springs R.R.'s; nearly 100 miles northwest of Columbia. The government census of 1900 gives the number of manufacturing establishments, 45; the amount of capital invested, $2,351,175; the number of employees, 1,375; the amount of wages annually, $276,042; cost of material, $923,217; and value of products, $1,630,275. It has cotton mills, and near the city are large limestone quarries, and gold and iron mines. Spartanburg is in an agricultural region in which the cotton product is important. The educational institutions are Wofford College (M. E. S.), founded in 1853, the Converse Street High School, public elementary schools, and the Kennedy Public Library. There are several private schools. There is one national and two state banks. The population more than doubled from 1890 to 1900, owing somewhat to the increase in the manufacturing, although during the same decade the manufacturing industries decreased in other parts of the State. The government is administered under a special charter which provides for a mayor and common council. Pop. (1890) 5,544; (1900) 11,395; (1910) 17,517.

Sparteine (derived from the Latin *spartum* and the Greek *σπάρτον*, Spanish broom), an alkaloid discovered by Dr. Stenhouse in 1851, and obtained from the tops of the broom-plant. It is a thick, colorless, transparent oil, with a peculiar, unpleasant odor and a very bitter taste. It boils at 288°, is strongly alkaline, sparingly soluble in water, very poisonous, and resembles nicotine in its compounds. Its sulphate is used in medicine as a cardiac stimulant.

Spartel, spär-těl', **Cape,** Morocco, Africa, the northwestern extremity of the continent. It is a promontory 1,030 feet high, situated at the western entrance to the Strait of Gibraltar.

Spar'tina. See GRASSES IN THE UNITED STATES.

Spasm, an involuntary convulsive contraction of a muscle or set of muscles which is of a more or less tonic or prolonged character. When similar involuntary contractions are intermittent or clonic in character, they are called convulsions. Convulsions usually imply some disturbance of the motor cortex. Spasms are generally of purely local origin; they are cramps. Spasms are sometimes held to be synonymous with tics (q.v.). In this sense it is the more modern distinction to regard spasm as a local irritant reflex act, convulsion an involuntary cortical reaction, and tic a hibitual muscular movement, originally voluntary, but become involuntary by frequent repetition. The word spasm, however, is used in all three conditions. Spasms occur in many forms of nervous disease, particularly in chorea, hysteria, hiccough, hydrophobia (q.v.), etc. The so-called facial spasm is a form of tic; bronchial asthma is a purely spasmodic affection of the muscular tissues of the bronchi; whooping-cough is largely spasmodic in its character.

Spasmod'ic School, in literature, a name applied in England to a group of English poets about the middle of the 19th century, among whom were Philip James Bailey, Sydney Dobell, and Alexander Smith. The name implied an overstrained and unnatural method of sentiment and expression, which sometimes grew out of sheer affectation.

Spav'in, a disease of horses affecting the hock-joint. It occurs under two principal forms. In young, weakly, or overworked horses the hock-joint is sometimes distended with dark-colored thickened synovia or joint-oil. This is bog spavin. Fomentations, occasional friction, a laxative diet, and rest should be diligently tried; and if such remedies prove unsuccessful the swelling must be dressed with strong blistering ointment or fired. The second variety, bone-spavin, is the more common. Toward the inside of the hock, at the head of the shank-bones, or between some of the small bones of the hock, appears a bony enlargement. At first there is tenderness, with heat, swelling, and considerable lameness; but as the inflammation in the bone and its investing membrane abates, the lameness may entirely disappear, or but a slight stiffness may remain. In recent and slight cases cold water should be applied continuously; but in serious cases, when the part is swollen and tender, hot fomentations are best. For several days they must be perseveringly employed. When the part is again cool and free from pain an iodide of mercury or fly-blister should be applied, and the animal treated to three months' rest in a small paddock, the end of a barn, or a roomy box-stall. In persistent cases firing or setoning usually gives much relief.

Spawn, the eggs or ova of fishes, frogs, and other of the larger aquatic animals. See EGG, and the names of various animals.

Spawn-eater, a local name for one of the commonest of brook-minnows or shiners (q.v.) (*Notropis hudsonius*), which is likely to eat the eggs of other fishes.

Digitized by Google

Speaker, one who presides over a deliberative assembly, preserving order, and regulating the debates; as, the Speaker of the House of Representatives, the Speaker of the House of Commons, etc. The Speaker of the House of Representatives is chosen by ballot from among the members upon the assembling of Congress, and occupies that office till the expiration of the body by adjournment *sine die.* If an extra session be called there is no new election of speaker, the same officer presiding over the deliberations. The presiding officer in the Senate is styled the President of the Senate, and he is not elected by that body, the office being held *ex officio* by the Vice-President of the United States. The Speaker of the House of Representatives exercises large influence on legislation, and representing, as he does, the majority in Congress, he is usually sustained.

The Speaker of the British House of Commons receives a salary of £5,000 a year, with a furnished residence. He is a member of the privy council, and ranks after the barons. On vacating his post he receives a pension of £4,000 and is raised to the peerage. The first time a speaker was appointed by this title was in the reign of Edward III., when Sir T. Hungerford was elected. On the continent of Europe the presiding officer of a legislative body is commonly designated by a title meaning "president." See UNITED STATES — SPEAKER OF THE HOUSE.

Speaking Trumpet, a metallic instrument of a somewhat conical form used for conveying the sound of the voice to a distance. The advantage of the conical form is satisfactorily explained on the assumption that waves of sound are reflected in the same way as rays of light, the angle of incidence and the angle of reflection being the same; for on this assumption it is evident that waves of sound proceeding from the narrow to the wide end of a truncated cone, from the walls of which they are reflected according to the law referred to, will gradually make smaller angles with the axis of the cone; or in other words, the direction of the sound will gradually become more nearly parallel to that axis. A cylindrical tube of uniform diameter has not the same effect, and accordingly is of no use in determining the direction of sound after it leaves the tube, although, as is seen in the case of speaking tubes used in offices, industrial establishments, and private houses, it is of great service in transmitting sound from one extremity to the other. Speaking-trumpets are chiefly used at sea, especially in windy weather, to convey commands from one part of the ship to another, and sometimes to speak with another ship.

Spear, Charles, American philanthropist and author: b. Boston, Mass., 1 May 1801; d. Washington, D. C., 18 April 1863. After several years' service as a Universalist minister in Brewster and Rockport, Mass., he settled in Boston, where he became well known by his advocacy of prison reform, and his efforts to secure the adoption of legislative measures for the benefit and reformation of prisoners. He visited penal institutions; made suggestions for the more humane treatment of convicts, housed many of them when discharged, and was active in securing employment for them and in promoting their spiritual welfare. He died of an infectious disease contracted in Washington during the Civil War while seeking to ameliorate the condition of prisoners of war. He was a regular contributor to several religious periodicals, was editor of 'The Prisoner's Friend' (1848–54); and was the author of 'Names and Titles of Christ' (1842); 'Plea for Discharged Convicts' (1844); 'Voices from Prison' (1849), etc. Consult Catharine Swan Brown, 'Life of Charles Spear' (1888).

Spear, Ellis, American soldier and government official: b. Warren, Knox County, Maine, 15 Oct. 1834. He was educated at Bowdoin College, graduating in 1858. During the Civil War he served in the national army, rising from the grade of a captain of Maine volunteers to colonel and commanding a regiment in the Army of the Potomac from 1863 to 1865. He was conspicuous as major commander of a brigade at Peebles Farm, and was made colonel for his bravery in action. In 1865 he was brevetted brigadier-general, became inspector of division, and before the close of the War was given the command of a brigade. At the end of the War he became identified with the United States Patent Office, and became commissioner of patents (1877–8).

Spear, James, American manufacturer: b. Mauch Chunk, Pa., 17 Feb. 1827; d. Wallingford, Pa., 30 Jan. 1902. He engaged in the manufacture of stoves in Philadelphia in 1848, invented various improvements in heating appliances, among them the anti-clinker grate now generally used, and he also invented the first practical car-heater. He was one of the founders of the Hayes Mechanics Home, a benefactor of various institutions, particularly the University of Pennsylvania, and was actively interested in the Blind Men's Home.

Spear, Samuel Thayer, American Presbyterian clergyman and author: b. Ballaston Spa, N. Y., 4 March 1812; d. Brooklyn, N. Y., 1 April 1891. He studied medicine, graduating in 1833 at the New York College of Physicians and Surgeons, but entered the ministry in 1835, after training at Troy, N. Y. After a pastorate at Lansingburg, N. Y., he was in charge of the South Presbyterian Church of Brooklyn, N. Y., from 1843 to 1871, when he became connected with the editorial staff of 'The Independent.' He was author of several works, including 'Religion and State' (1876); and 'The Bible Heaven' (1886).

Spear, a weapon of offense, consisting of a wooden shaft or pole varying in length up to eight or nine feet, and provided with a sharp piercing point. The spear may be regarded as the prototype of the various forms of piercing weapons, such as the arrow, bolt, and dart, which are projected from bows, catapults, or other engines, and the javelin, assegai, and lance, held in or thrown by the hand. The longer and heavier spears and lances are mainly retained in the hand while in use, but there is no absolute distinction, and the throwing of a spear has in all ages been a form of offensive warfare.

In its earliest form the spear would naturally consist of a simple pole of tough wood sharpened to a point at one extremity, which point might be both formed and hardened by charring in fire. From this an improvement would consist in fitting to the shaft a separate spear head of bone, as is still practised among primitive races.

Digitized by Google

The war lance of the mediæval knights was 16 feet long; the weapon of modern cavalry regiments known as lancers may be from 8½ to 11 feet long, usually adorned with a small flag near the head. The Persians at the present day forge spear heads for ornamental purposes only, with two and sometimes three prongs. The modern spears of savage tribes, used equally for hunting and for warlike purposes, are frequently barbed with fish and other bones, and their fighting spears have sometimes poisoned tips. Among civilized communities the hunting spear continues to be used for following the wild boar and other large game, while the Cossacks of Russia, and various corps in the armies of western Europe, are armed with spears or lances, which experience has shown to be efficient weapons for cavalry. The spear was not an ordinary weapon among the North American Indians, who before the introduction of the musket among them, used the bow and arrows, and the tomahawk.

Spearfish. (1) One of the carp-suckers (q.v.), a species (*Carpiodes velifer*) of the Mississippi Valley; (2) a large deep-sea, predatory fish of the warmer parts of the Atlantic allied to the sailfishes (q.v.), and placed in the genus *Tetrapturus;* the best-known species is the bill-fish (*A. imperator*), called aguja by Spanish-speaking fishermen.

Spear'man, Frank Hamilton, American novelist: b. Buffalo, N. Y. For some years he engaged in commercial life, but since 1895 has devoted himself to literary work. He is the author of 'The Nerve of Foley' (1900); 'Held for Orders' (1901); 'Doctor Bryson' (1902).

Spear-mint, a European labiate herb (*Mentha spicata*), which has become perfectly naturalized in America, and is often found in damp places. It is about two feet high, smooth, square-stemmed, and spreading by leafy stolons. It bears opposite, lanceolate, sharply serrate, smoothish leaves, and small, 2-lipped, purplish flowers in slender verticillate spikes, which are both lateral and terminal, the latter being the longest. Spear-mint is cultivated for its very aromatic foliage, which yields a carminative oil, and was an old-time remedy for flatulence. It is now chiefly employed, with vinegar, as a fitting sauce for roast lamb, and sprigs of it are the crowning feature of the seductive mint-julep.

Spears, spērz, **John Randolph,** American author and journalist: b. Van Wert, Ohio, 21 April 1850. Among his many publications are 'The Gold Diggings of Cape Horn' (1895); 'The Port of Missing Ships' (1896); 'The History of Our Navy' (1897); 'The History of the American Slave Trade' (1900); 'Anthony Wayne' (1903); 'The History of the Mississippi Valley' (1903).

Special Sessions, Court of. See Court.

Specie (spē'shē) **Circular,** a treasury circular drafted by Senator Benton and issued at President Jackson's orders 11 July 1836, which directed that nothing but gold and silver should be received in payment for the public lands. The next Congress passed a bill to rescind this specie circular, but President Jackson killed it by a veto. It was claimed by President Jackson's opponents that the circular contributed greatly to bring about the ruinous financial crisis of 1837.

Specie Payments, in finance a payment in coin or any metallic money; a medium of exchange authorized by the government or state. In modern times specie is largely used by banks as security for paper money in circulation. In times of financial stringency the amount of coin on hand is inadequate to cover the volume of paper in circulation; hence arises a temporary condition called suspension of specie payment. When conditions change and finances improve a resumption of specie payments generally ensues.

Specie Resumption. The resumption of specie payments after the close of the American Civil War was a subject of long and anxious discussion in Congress and in the press. In 1861 payment in specie was suspended by the government and by banks throughout the United States, and Congress authorized the issue of United States notes to meet the expenses of the conflict, and to be accepted as legal tender for all dues except customs. The receipt of specie for customs duties kept the treasury well supplied with gold and silver, and enabled the government to meet obligations payable in coin. After the war, and indeed from the closing scenes of the Confederacy, the premium on gold gradually fell until it was merely nominal, but the fact that the government's paper currency was not redeemable on presentation in coin kept that currency from being at par, and tended to unsettle business, and to provoke, or afford an excuse for serious financial crises. The question of resumption was most earnestly agitated after the panic of 1873, and on 14 Jan. 1875 an act was passed by Congress, ordering the resumption of specie payments to begin on 1 Jan. 1879. The approach of that date was attended by great apprehension in the United States and abroad that the national treasury would be unable to meet the overwhelming demand for specie that many expected to occur. The mints were run far beyond the usual hours coining money to meet possible requirements, and there was much surprise when the appointed date came, and very little currency was presented for redemption. The people were satisfied of the government's ability to pay, and gold at once fell to par. "Greenbacks," as the national currency is called, became the equivalent of gold throughout the world, and have ever since maintained that position.

Species, a group of individuals which agree in exhibiting certain distinctive hereditary characters of sufficient importance to render a particular name convenient. When we familiarly talk of the different "kinds" of plants and animals, we indicate in a rough way the biological idea of species; and the recognition of raven, jackdaw and rook, as different kinds of crow, corresponds with the scientific distinction of these as four different species of the genus *Corvus.* (See Genus.) In many a case, however, where the distinctive hereditary characters are less conspicuous, the ordinary observer may see only one "kind" where the trained naturalist detects many "species." Moreover, where a naturalist unfamiliar with the details of a particular class of animals might discern only half a dozen distinct species, the specialist may distinguish a score. In fact, the conception of species is entirely relative to convenience; where the "lumpers" think

Digitized by Google

a score of special groups with special names quite sufficient, the «splitters» may think it necessary to distinguish a hundred. Except in cases where the limitations of group from group are very clear, as in the case of the four «kinds» of crow above mentioned, it requires a period of criticism before a satisfactory compromise between the «lumpers» and the «splitters» can be arrived at. And the reason for this is simply that in many cases one species is linked to another by intermediate varieties, and, it may be, also by hybrids.

Collections of definitions of «species» have often been made; and the curious will find a score in Quatrefages' posthumous work, 'Darwin et ses Précurseurs Français.' Thus, Linnæus wrote: «Species tot numeramus quot diversæ formæ in principio sunt creatæ.» Buffon defined species as «a constant succession of individuals similar to, and capable of reproducing each other.» De Candolle said that a species was «an assemblage of all those individuals which resemble each other more than they do others, and which are able to reproduce their like, in such a manner that they may be supposed by analogy to have descended from a single being or a single pair.» Quatrefages' idea of species is summed up in his statement that it is «an assemblage of individuals more or less resembling one another, which are descended, or may be regarded as being descended, from a single pair by an uninterrupted succession of families.» Müller says species is a «living form, represented by individual beings, which reappears in the product of generation with certain invariable characters, and is constantly reproduced by the generative act of similar individuals.» These illustrations may suffice to impress the fact that the *invariable* nature of species had become firmly fixed on the minds of the older naturalists in former years.

A species, it may safely be concluded, represents no immutable, fixed, or unvarying group, but a very variable one, differing widely in the extent of its variation in different cases. A species is a relative and subjective conception; the reality is in the component individuals. See EVOLUTION; SPECIES, EXTINCTION OF.

Species, Extinction of. The particular reasons for the extinction of animals and plants are not always obvious, and may be very difficult of interpretation. Barring some factors to be mentioned later, the same variations of environment and most of the forces of selection considered as necessary to the production of new species are also powerful agents in the extermination of established forms. The history of many species may be compared to that of an individual. It has its birth, its growth, its decline, its death. Also, the laws of evolution show that many other species undergo modifications or changes which ultimately transgress or supplant the original assemblage of specific characters, so that a new species results by a process of mutation. Furthermore, many other species, while retaining their strictly specific characters, may be translated into different genera through modifications of their generic characters.

The continuance of a species depends upon its harmony with its environment. A perfectly stable and continuous environment is obviously a natural impossibility. The physical conditions of any region of the earth are in a state of constant change, sometimes very gradual and extending over long periods of time, sometimes sufficiently rapid to be measured by ordinary standards. The organic agencies surrounding any species are also not permanent; migrations are continually going on; the areas occupied by various organisms are being extended or reduced; periods of excessive or repressed fecundity often occur; there are times of abundance and scarcity of food, increase and diminution in the number of enemies, and so on. Any material change in the physical or organic environment must produce a readjustment among the individuals composing a species; their number may be lessened or increased, or they may be forced into conditions of life which produce changes in habits, place of abode, food, function, structure, or organs.

The study of a geographic life-province shows that the organisms inhabiting it are in the state of a moving equilibrium. Minor changes in the physical conditions, as slight differences in temperature, moisture, elevation, etc., may be compensated for by a readjustment among the organisms themselves. In some cases this readjustment may be favorable to many of the species, while in others it may initiate changes which ultimately result in extinction. More profound changes in the physical environment necessarily produce a greater effect upon the animals and plants, and may result in the extermination of many and the considerable modification of others, so that a distinctly transmuted fauna and flora would occupy the region.

The forces already mentioned, though operative to a greater or less degree, are not believed to affect so immediately the equilibrium of a species or the general equilibrium of a biotic province as the invasion of new species, either by extension, migration, or evolution. The struggle for existence amid gradually changing physical conditions alone is not so aggressive as the invasion of a new assemblage of plants and animals; for in the former the struggle is the normal result of the physical and organic forces of an environment in which the adjustments have been made and an equilibrium reached; in the other there is the direct addition of a new set of opposing forces, requiring the immediate readjustment of both the invading and invaded organisms.

A census of the animals and plants of any region will show a great variation in the number of individuals representing the various species. Some are abundant, some common, while others are rare. Now, since the normal impulse of the individuals of each species is to increase inordinately, the fact that some are of rare occurrence shows that forces are at work tending to check their multiplication, and the relative rarity of a species, as compared with others of the same genus, is taken as an indication of approaching extinction.

The development of spines, thorns, prickles, or horns on animals and plants has been shown by the writer to represent an advanced stage of evolution within the type, as well as the degree of differentiation of the organism, the ratio of its adaptability to the environment, and the measure of its vital power. The study of the life-histories of spinose forms shows that they are simple and inornate during their young stages, and their phylogeny shows that they were

Digitized by Google

all derived from non-spinous ancestors. It is further believed that spines represent an extreme of superficial differentiation which may become fixed in ontogeny, and also that spinosity represents a limit to morphological and physiological variation. Therefore, after attaining the limit of spine differentiation, spinose organisms leave no descendants, and out of spinose types no new types are developed.

The factors as above partly noted affecting the continuance or life of a species may be divided into two classes: (1) those residing within the individuals of a species itself (intrinsic), and (2) those extraneous to the species (extrinsic). The action of either the intrinsic or extrinsic factors tends to result either in extinction or in the mutation of a species into another form. In both cases a specific type disappears or is eliminated, although only in the first instance is the species exterminated in the sense that it has left no descendants. Within the limits of this article but little more than a descriptive statement of these principal factors can be attempted. It should also be borne in mind that there is an overlapping and interdependency among the factors, causing them to react upon each other. Thus, an unfavorable environment due to change of climate may affect the food (extrinsic), which in turn may affect the vitality of the species, possibly resulting in degeneracy (intrinsic).

Intrinsic Factors of Extinction.— Under this head may be considered such factors as (1) lack of power of adaptation; (2) lack of vitality; (3) overspecialization; (4) old age (gerontic stage of evolution); (5) pathologic condition; (6) degeneracy; (7) inbreeding; (8) mutation. When a species cannot accommodate itself to changes of climate, food, etc., or in any way becomes fixed, it must perish unless it can find a suitable and constant environment — a physical impossibility. The waning vitality so plainly expressed by many species must be considered as evidence of approaching extinction. Such species usually occupy restricted geographic provinces, they are generally not numerically abundant, and their powers of reproduction are more or less retarded or repressed. An animal or plant which becomes so specialized that it can live only under certain peculiar conditions stands a chance of extermination whenever the harmony of these conditions is disturbed. Thus a plant which depends upon a certain species of insect for its fertilization will succumb if the insect seeks other food or is itself extirpated from any cause. Also, an animal depending solely upon a species of plant for food, or requiring a certain elevation or range of temperature for its continuance, will be exterminated when these are disturbed, unless it can adapt itself to the change. Specialization in general is manifested by the departure of organs or sets of organs from what is normal to the class. It results in the extreme differentiation of previous structures, or in their suppression, generally due to disuse or restraint, and also in a perversion of their original function. It has been shown by the study of many instances of extinct species preserved in the rocks of past geological periods, that each species has its period of birth, youth, maturity, and old age, which often may be recognized by distinctive individual or numerical characters; so that whenever a species can be shown to possess what are known as gerontic or old-age characters it can be safely predicated that its extinction is near at hand. Pathologic characters in a species indicate the same conditions as disease in an individual, and point clearly toward extermination. Adverse conditions may affect the entire fauna and flora of a region, producing dwarfed, depauperate, and pathologic species. Their history is usually very brief and their places are taken by organisms in accord with the environment. Retrogressive evolution indicates that the race has not only ceased to advance, but is declining. The history of any genetic line of species shows that whenever retrogressive characters appear and constitute dominant features the rapid decline and extinction of forms possessing them is imminent. The reduction of a species numerically, and its restriction within narrow geographic limits, lead to inbreeding and the consequent impairment of virility. The small herds of European bison preserved by the Russian government in the forests of Lithuania and the Caucasus are rapidly declining, both numerically and in vitality, due almost wholly, according to recent reports, to inbreeding. Each species now existent must have had an ancestor from which it has been derived through one or more of the many processes of evolution. Some of these ancestral types may be still living, while others are extinct. Going back to past geologic times (for example, to the Carboniferous) each species was derived by evolution from ancestral species. Both the ancestors and all the species once living in the Carboniferous are now extinct. Life, however, was continued on into the next age through modified descendants of a percentage of true Carboniferous species. The rest were exterminated and left no descendants. In the first instance it is extinction by mutation and in the second extinction by extermination. It seems probable that ever since the earth has been fully tenanted with a varied life there has been a fairly constant ratio at all times between the number of species just exterminated, the number of primary species originating by the mutation of ancestral forms, the number of species arising by the special differentiation of the primary species, and the number of species adapting themselves to the changes which are dominant during the succeeding geologic period.

Extrinsic Factors.— Agencies outside of the organism itself which in their operation may cause extermination of species may be grouped under the following heads: (1) Unfavorable physical environment; (2) changes affecting the food-supply; (3) preponderance of enemies; (4) the agency of man; (5) cataclysms. A physical environment which can properly be considered unfavorable must act on the individuals of a species in an adverse manner, and necessarily the result is deleterious to its continuance. The unfavorable characters of the environment may be various, as too high or too low temperatures, excessive moisture or dryness, unsuitable altitude, storms, winds, polluted and sediment-laden waters, etc., any of which, if not normal to the requirements of the organisms, will have a repressive effect on their growth and multiplication. The persistence of these inhibitory conditions will generally cause the speedy extinction of the species. The life of any organism is so dependent upon the stability of the food-supply that any change which seriously

Digitized by Google

affects the kind and amount of food reacts immediately upon the species which rely upon it for sustenance. The extinction of a species from any cause involves either the extinction of the organisms dependent wholly upon it, or their adaptation to new conditions. Such of these as have lost their plasticity, either from high specialization or girontic development, will perish. The invasion of any province by a new fauna or by a new flora or by both combined will initiate a struggle for supremacy of occupation which will drive out some species, exterminate others, and modify still others. In these changes the food is an important element in determining the success or failure of a species to maintain itself. On the otner hand, abundance of food leads to sluggish habits and tends to produce increase in size. In this way may be explained the prevalence of many large contemporaneous species of reptiles in the Mesozoic, and of large mammals at different epochs in the Tertiary. This increase in size exposed them to increasing danger from starvation, from changes in climate, and from competition with smaller active and more numerous animals. It is difficult to estimate how far in some cases the extinction of a species may have been due to the invasion of noxious bacteria or other parasitic organisms. It can only be predicated that their ravages are sometimes of such a nature that the ranks of a species are thinned out to the verge of extinction, and it is quite possible that actual extermination occasionally has occurred through this cause. Dr. Falconer believed that insect enemies have prevented the increase and extension of the elephant in India, and Darwin likewise stated that the increase of large quadrupeds in some parts of South America was prevented by insects and blood-sucking bats. It is doubtful, however, whether these agents were ever the primary and sole causes of the extinction of any large animal. The most vulnerable point of attack in the extermination of large animals is their young or their eggs. Animals of large size usually lay few eggs or bring forth very few young, and usually at infrequent intervals. The eggs or the young are easily destroyed by small creatures that would be powerless before the full-grown animals. The downfall of the great reptiles at the end of the Mesozoic has been explained by Morris as due (1) to the lack of care reptiles in general take of their eggs or young; (2) to the smaller number of eggs laid by the large species as compared with the smaller, whose continued existence in some measure is owing to their fecundity; and (3) to the progressive development of the mammals into egg-eating and predaceous placental forms of higher intelligence, at the close of the Mesozoic.

Agency of Man.— Man, being the dominant organism of the existing fauna and flora, has since his establishment had an increasing effect in the restriction and extension of contemporary plants and animals. As compared with the ordinary forces of nature, which in general work in an almost imperceptible manner when measured by human standards, man's influence has been incisive, profound, and very rapid. He has been the only animal that has attempted to conquer nature in an intelligent manner for his own ends. Noxious animals and plants have been persistently attacked until many of them through reduction in numbers or by extinction have ceased to be a menace to his well-being. His inordinate greed has also led him to exterminate harmless useful animals by wholesale slaughter, chiefly because they offered little or no resistance, and also from a false notion that nature's resources are inexhaustible. (See Extinct Animals.) Along with man's conscious destruction of life, he has indirectly and without purpose accomplished the extermination of species to which he was wholly indifferent. This fact necessitates the division of this topic into two parts: (1) organisms directly exterminated by man, and (2) organisms indirectly exterminated by man. It is well known that the remains of early prehistoric man are found associated with the bones of extinct animals. Among these may be mentioned the mammoth, mastodon, cave-bear, cave-hyena, sabre-toothed tiger, Irish elk, woolly rhinoceros, the giant birds of Madagascar and New Zealand, and many others. While it is impossible to assert positively that their extermination was due wholly to man, yet undoubtedly man was one of the most powerful agents. Otherwise it is difficult to account for the disappearance of an animal from a continent that in some parts, at least, would furnish the proper climate and food for its continuous existence, from the time of primitive man down to the historic period. Even with the crudest of weapons, man with his superior cunning and intellect could successfully wage a war of extermination on such animals as the mammoth and mastodon by a method already mentioned; namely, that of killing the young.

Coming now to within the historical period, there are quite a number of well-authenticated cases of the extermination of species that can be traced directly to man as either the principal or sole agent. A few instances will be mentioned in this connection, and the list could be easily extended. Probably the best-known example of an animal exterminated by man is the dodo (q.v.), a large flightless bird related to the dove, formerly living on the island of Mauritius. Its clumsy helpless condition made it an easy prey, and the introduction of cats, dogs, and pigs into the island hastened its extermination. On the islands of Rodriguez and Bourbon of the same group were found the solitaire (q.v.) and at least two other species of birds related to the dodo. They also soon disappeared after man's occupation of the islands. The great auk (see Garefowl) formerly ranged from the northeastern coast of the United States northward to the Arctic regions, and thence along the shores of northern Europe. It was at one time extremely abundant, but the last two individuals seen were taken near Iceland in 1844. The great northern sea-cow (q.v.) and Pallas cormorant, natives of the Commander Islands, became extinct near the close of the 18th century. The disappearance of the ure-ox from Europe is also well known. When the Bermudas were first settled in 1612, a food-bird known as the Cahow bred in almost incredible numbers of several of the smaller islands. By 1616 it was almost exterminated, and a reference to the bird in 1629 states that it no longer existed. Singularly enough no remains of this bird have yet been discovered. The sickle-bill, a bird formerly used for making the

Digitized by Google

royal robes in the Sandwich Islands, is now no longer living, having been hunted to extinction.

The introduction by man of various species of plants and animals into a region where they formerly did not exist has in some cases profoundly changed the native fauna and flora. A single well-authenticated illustration will suffice, though many more could be adduced. The island of Saint Helena was discovered about the year 1506, and at that time was densely covered with forests. In a little more than 300 years, fully five sixths of the island were made entirely barren, and, as reported by Dr. Hooker, most of the existing vegetation was not indigenous but consisted of plants introduced from Europe, Africa, America, and Australia. These exotic species, together with the goats, were carried to the island through the agency of man. The goats destroyed the forests by eating the young plants, and the native vegetation could not compete in the struggle with the introduced species. It is estimated that 100 peculiar and indigenous species were extirpated in this manner, and all record of them is lost except a few species preserved in the Kew herbarium.

Besides the species already exterminated by man, it should be noted that many others were once abundant and widespread that are now reduced in numbers and restricted in range. Their final extinction seems to be a matter of a few years only. Among these may be mentioned the American buffalo, the fur-seal, the beaver, the elephant, and the big-tree of California.

The violent catastrophes of nature seldom affect more than a very limited area of the globe, and species that are cosmopolitan or of wide geographic distribution would not be in danger of extermination. When, however, it is realized that some species are so restricted in their province as to occupy a single valley or a small island, then it is easy to believe that at rare intervals some great and sudden upheaval, subsidence, hurricane, or volcanic outbreak may have destroyed all the individuals of certain localized species, if any such were within the area of disturbance. A West Indian hurricane in 1898 is believed to have totally destroyed a species of humming-bird peculiar to the island of Saint Vincent, though it is doubtful whether the great eruption of Krakatoa in 1883 and of Mont Pelée in 1902 exterminated a single species of animal or plant.

A review of the various causes of extermination shows that on account of their diversity and often extremely slow action it is difficult in any particular case to explain the total disappearance of a species unless a detailed knowledge can be obtained of the principal agencies affecting in any way the harmony of its surroundings or its ability to maintain its numbers in its natural province.

Bibliography.— Bailey, 'The Survival of the Unlike' (1896); Beecher, 'The Origin and Significance of Spines,' in the 'American Journal of Science' (1898); Cope, 'The Primary Factors of Organic Evolution' (1896); Crampton, 'A Suggestion on Extinction,' in Proceedings of the Royal Physiological Society, Edinburgh (1901); Darwin, 'Origin of Species' (1866), and 'Journal' (1872); Hutchinson, 'Extinct Monsters' (1892), and 'Creatures of Other Days' (1894); Lucas, 'Animals of the Past' (1901); Lyell, 'Principles of Geology' (10th edition, 1868); Morris, 'The Extinction of Species,' Proceedings of the Academy of Natural Sciences, Philadelphia (1895); Topinard, 'Anthropology' (1878); Verrill, 'The Bermuda Islands,' Transactions of the Connecticut Academy of Arts and Sciences (1901-2); Wallace, 'The Geographical Distribution of Animals' (1876).

CHARLES EMERSON BEECHER,
Professor of Palæontology, Yale University.

Specific Gravity. The specific gravity of a body is the ratio of the mass of that body to the mass of an equal volume of some standard substance which is arbitrarily selected for purposes of reference. In the cases ot solids and liquids it is customary to select water as the standard substance; and water is always understood, in connection with solids and liquids, unless the contrary is explicitly stated. Gases are also sometimes referred to water, but it is much commoner to compare the density of a gas with that of air or hydrogen. The specific gravity of a solid which is not affected by contact with water may be determined by weighing the solid twice — once while it is surrounded with air, and once while it is submerged in water. The difference between the two weights so obtained gives the weight of a mass of water whose volume is equal to that of the solid; and hence, in order to determine the specific gravity of the solid, it is only necessary to divide the weight as observed in air by the loss of weight when it is submerged in water. If the solid is soluble in water, or if it is affected by water in any other manner, its specific gravity must be determined by some indirect method. Many such methods are known. For example, we may replace the water by some other liquid, such as benzene, in which the solid is not soluble, and then perform the experiment precisely as described above. The result so obtained is the specific gravity of the substance with reference to the benzene (or whatever liquid is employed in its place); and in order to express the specific gravity of the body with reference to water we have merely to divide its value with respect to benzene by the specific gravity of the benzene, as compared with water.

The specific gravity of a liquid may be determined very accurately by means of the "specific gravity bottle." This is a bottle made of thin glass (so as to be light), and provided with a ground-glass stopper. The weight of the bottle is determined (1) when it is empty, (2) when it is filled with water, and (3) when it is filled with the liquid whose specific gravity is desired. From these data we can easily determine the weight of the water in the bottle, and also that of the second liquid; and upon dividing the latter by the former we obtain the specific gravity sought. The specific gravity of a liquid may be obtained more expeditiously (though less accurately) by means of the simple instrument known as the hydrometer. This consists essentially of a cylindrical glass bulb, provided at its upper end with a graduated stem, and weighted at its lower end with shot or mercury, so that it will float in an upright position when placed in a liquid sufficiently dense to permit it to float at all. It is evident that such an instrument will be buoyed up more by a dense liquid than by a lighter one; and when the stem at its upper end has once been graduated correctly we have only

Digitized by Google

to place the hydrometer in the liquid whose specific gravity is desired, and observe the depth to which it sinks, as read from the graduated stem. In Fahrenheit's form of the instrument there is only one graduation mark on the stem; but a small pan is provided at the top of the hydrometer, and the observation consists in determining what weights must be placed upon this pan in order to cause the instrument to sink to the standard level indicated by the mark on the stem. Hydrometers are often graduated for special purposes, so that instead of indicating the specific gravity of the liquid in which they are placed, their readings give at once the percentage of alcohol (or of some other substance) that is present. Such instruments are called alcoholometers, salimeters, lactometers, etc., according to the special kind of liquid for whose investigation they are graduated.

As the density of water varies with the temperature, it is necessary, if we are to have a standard of density that is definite and accurate enough for scientific purposes, to specify the temperature of the water with which the comparison is made. In England the standard temperature of the water was formerly taken at 62° F.; but it is now the almost universal practice to make the comparison with water at its temperature of maximum density, or at about 39° F. In the vicinity of this temperature, the density of water varies very slowly with the temperature, and hence in comparing the density of a substance with that of water at or near 39° F., it is not essential to observe the temperature of the water with any high degree of precision. It was, indeed, this convenient and practical fact which led to the adoption of 39° F. as the standard temperature of the water.

Following are the specific gravities of various substances, as compared with water at 39° F.; the temperature of the substances being also supposed to be 39° F., except when otherwise specified. It is to be understood that the specific gravity of a solid varies to some extent with the physical condition of the solid. The following values, however, are sufficiently accurate for general purposes; and more precise information is given in this encyclopædia, in many cases, in the articles upon the several substances named:

TABLE OF SPECIFIC GRAVITIES.

Aluminum	2.68
Antimony, cast	6.71
Bismuth, cast	9.82
Brass	8.38
Coal, compact	1.32
Copper, drawn	8.88
Copper, cast	8.79
Diamond	3.52
Gold, stamped	19.36
Gold, cast	19.26
Graphite	2.30
Melting ice	0.92
Iron, wrought	7.79
Iron, cast	7.21
Lead, cast	11.35
Phosphorus	1.83
Platinum, rolled	22.07
Potassium	0.86
Pyrites, iron	5.00
Quartz	2.65
Silver, cast	10.47
Sodium	0.97
Steel, not hammered	7.82
Sulphur, native	2.03
Tin, cast	7.29
Zinc, cast	6.86
Sulphuric acid	1.85
Carbon disulphide	1.29
Nitric acid	1.42
Chloroform	1.52
Glycerin	1.26
Hydrochloric acid	1.24
Blood	1.06
Milk, cow's	1.03
Sea-water	1.03
Olive oil	0.91
Turpentine	0.87
Ether (at 70° F.)	0.72
Alcohol, absolute (at 70° F.)	0.80
Bromine (at 32° F.)	3.19
Mercury (at 32° F.)	13.60

The term specific gravity is not now used as commonly as it formerly was, the density of the substance being spoken of instead; it being understood in such cases that it is the density of the substance relatively to water that is meant, and not its absolute density as expressed in units of mass per unit of volume. In the system of units employed in the United States and in England, this double use of the word density may sometimes lead to confusion. The metric system is now, however, very largely used in scientific work, and here the confusion cannot well occur; for in the metric system the unit of mass (the gram) is the mass of a cubic centimetre of water at its temperature of maximum density; and hence, in this system, the "absolute density" of a substance, and its "density relatively to water," are one and the same thing.

In the case of gases the expression specific gravity is now almost never used; density having practically displaced it. The accurate determination of the density of a gas is very difficult, and calls for great experimental skill and the finest of apparatus. In the usual method of performing such a determination a pair of glass globes, as nearly identical as possible, are suspended from the respective arms of a delicate balance, and weights are added at one end or the other until perfect equilibrium is attained. One of the globes is then thoroughly exhausted by means of an air-pump, while the other is filled with the gas under examination. The equilibrium of the balance will be destroyed by this process, and if we restore it by adding weights to the arm carrying the exhausted sphere we shall thereby ascertain the weight of the gas in the other sphere. By repeating the experiment with gases of different kinds the weights of equal volumes of these different gases will be ascertained; and if the various weights so obtained are all divided by the weight as obtained for hydrogen (for example), the quotients will be the densities of the various gases, with respect to hydrogen. The relative densities of some of the more familiar gases are given in the following table, it being understood that the pressure in every case is one atmosphere, and the temperature 32° F. The relative densities of the gases here given do not change much for considerable variations of temperature and pressure; but this constancy is only approximate, not absolute; and hence, in the interest of accuracy, it is desirable to state (as above) the precise conditions under which the table is exact.

DENSITIES OF GASES, RELATIVELY TO HYDROGEN.

Hydrogen	1.000
Methane ("marsh gas")	8.118
Ammonia gas (NH_3)	8.592
Carbon monoxid	13.78
Nitrogen	14.02
Ethylene (olefiant gas)	14.18
Air, dry	14.44
Oxygen	15.96
Carbon dioxid	22.08
Cyanogen	26.01
Sulphur dioxid	30.54
Chlorine	34.98

Digitized by Google

According to the experiments of Regnault, a cubic centimetre of hydrogen, at the freezing point of water and under a pressure of 760 millimetres of mercury at Paris, weighs 0.00008956 grams; and from this fundamental constant it is easy to find the weight, under these same conditions, of a cubic centimetre of any of the gases whose densities with respect to hydrogen are given in the foregoing table.

Consult standard works on general physics, and especially Ganot, 'Elementary Treatise on Physics.' A. D. RISTEEN, PH.D.,
Editorial Staff, 'Encyclopedia Americana.'

Specific Heat. Maxwell defines this expression as follows: "The specific heat of a body is the ratio of the quantity of heat required to raise [the temperature of] that body one degree, to the quantity required to raise [the temperature of] an equal weight of water one degree." For most engineering purposes, and for rough calculations of all kinds, this definition is sufficiently accurate. It assumes, however, that the quantity of heat required to raise the temperature of one pound of water by one degree is the same in all parts of the thermometric scale; and while this is approximately true, it cannot be admitted when we have to deal with heat-measurements of a high order of precision. We must then define the specific heat of a body as the number of units of heat that must be added to a unit mass of the body, in order to raise the temperature of the body by one degree; a unit of heat being simultaneously defined as the quantity of heat that is required in order to raise the temperature of a unit mass of water by one degree at some particular part of the thermometric scale. Various suggestions have been made as to the particular temperature that the water should have, in the definition of the unit of heat; and different experimenters have used different units, to the great confusion of the subject of heat-measurement in general. There is now a marked tendency toward the general adoption of a temperature of about 15° C. (59° F.); so that a unit of heat would be defined (in the metric system) as the quantity of heat that is required to raise the temperature of one gram of water from 14.5° C. to 15.5° C.; and in the familiar English and American system the unit would be similarly defined as the quantity of heat required to raise the temperature of a pound of water from 58.5° F. to 59.5° F. Adopting this definition of the unit of heat, we may speak of the specific heat of water itself; the specific heat of that fluid at $t°$ C. being the quantity of heat required to raise the temperature of a certain mass of water by one degree at $t°$ C., divided by the quantity of heat required to raise the temperature of an equal mass of it by one degree at the temperature 15° C. It is easily seen that it is of the highest importance to the physicist to know precisely how the specific heat of water (as thus defined) varies with the temperature $t°$; and it might not unreasonably be assumed that this fundamental matter would early have received a satisfactory amount of attention. Such was not the fact, however. Regnault indeed made an elaborate study of the subject, and published his results in the tenth memoir of his first series (1847). His conclusions were accepted for many years, but it is now known that they are incorrect, the data that he gives being even inconsistent among themselves. The general acceptance of Regnault's work on the specific heat of water has vitiated many otherwise important researches on the subject of heat; but we are now in possession of data that appear to be very much superior, and the confusion that has prevailed in the past is likely to be avoided in the future. (With reference to Regnault's work on water, see a letter by J. Macfarlane Gray in 'Engineering' for 9 Jan. 1885, p. 42; also a more extended discussion in the same journal for 12 July, 1889, p. 57; also, Wüllner, 'Lehrbuch der Experimentalphysik,' ed. of 1896, Vol. II., p. 488; and E. H. Griffiths, 'Philosophical Magazine,' November (1895).

Rowland, in connection with his famous work on the mechanical equivalent of heat (1879), carefully investigated the specific heat of water over a range of temperature extending from 0° C. to about 40° C., and he first showed that in this interval the specific heat of water decreases with rising temperature, attaining a minimum value somewhere about the temperature 30° C. (Rowland, 'Physical Papers,' p. 387.) Other experimenters have since corroborated his results; but it was not until 1902 that a complete series of apparently satisfactory measurements of the specific heat of water from the freezing-point (q.v.) to the boiling-point (q.v.) were published. These are due to H. T. Barnes, of McGill University, Montreal. Mr. Barnes assumes 16° C. as the temperature at which the specific heat is unity (that is, he takes, as his unit of heat, the quantity of heat required to raise the temperature of a gram of water by one degree Centigrade, at 16° C.). His results ('Philosophical Transactions,' A, Vol. 199, p. 149) are as follows:

SPECIFIC HEAT OF WATER AT VARIOUS TEMPERATURES, IN TERMS OF A THERMAL UNIT AT 16° C. (BARNES.)

Temperature	Specific heat	Temperature	Specific heat
5° C.	1.0053	55° C.	0.9985
10	1.0023	60	0.9991
15	1.0003	65	0.9997
20	0.9990	70	1.0004
25	0.9981	75	1.0010
30	0.9976	80	1.0017
35	0.9974	85	1.0024
40	0.9974	90	1.0030
45	0.9976	95	1.0037
50	0.9980		

The variation, as will be seen by the table, is quite small, and for many purposes the specific heat of water may be taken as unity at all temperatures. This will be assumed to be the case in the illustrations and explanations which follow; for the corrections which must be made in order to take the actual variation into account are tedious, and their accurate comprehension and application imply a certain knowledge of practical physics which the reader cannot be assumed to possess.

The specific heat of a body which is not affected by contact with water, may be determined by heating the body to a known temperature, and then immersing it quickly in a definite mass of water whose initial temperature is also known. If we denote the mass of the water by W and that of the body under investigation by M, and if T_1 is the initial temperature of the water, and T_2 that of the body, and if S is the specific heat of the body and T is the final tem-

Digitized by Google

perature that the body and the water have in common, we may calculate the specific heat, S, as follows: The temperature of the water has been raised from T_1 to T, and the mass of the water is W pounds, or grams, as the case may be. Then it follows that the number of units of heat that have been absorbed by the water is $W(T-T_1)$. Similarly, the body has cooled from T_2 to T, and its mass is M. Hence if the body had a specific heat precisely equal to that of water, we should know that it had given up $M(T_2-T)$ units of heat. Its actual specific heat, however, is S; and hence it follows, by the definition of specific heat, that the actual quantity of heat given out by the body is $SM(T_2-T)$ units. As we shall suppose that the radiation and conduction of heat between the apparatus and outside objects is negligible, it follows that the quantity of heat given out by the body is equal to the quantity absorbed by the water; that is, we must have the equation

$$W(T-T_1)=SM(T_2-T)$$

And from this we easily find

$$S=\frac{W(T-T_1)}{M(T_2-T)}$$

In the actual conduct of an experiment of this kind there are many difficulties to overcome, and many corrections to be estimated and applied. There is always more or less communication of heat between the apparatus and outside objects, and the heat that is given out by the cooling body warms not only the water, but also the containing vessel, the thermometers, and the stirring apparatus.

In determining the specific heat of a body advantage is often taken of the known fact that the quantity of heat required to melt one pound of ice at 32° F. is approximately the same as the quantity of heat required to raise the temperature of one pound of water by 140° F. In the application of this fact to the determination of specific heats the body under investigation is surrounded by ice, and the number of units of heat that are given off is determined by observing the quantity of ice that is melted, and multiplying that quantity (as expressed in pounds) by 140. Bunsen devised a very delicate apparatus for the execution of this sort of measurement. In his instrument the body to be studied is placed in a cup-shaped depression in a glass vessel that is filled with ice and water, and which is entirely sealed, save for a graduated capillary tube, one end of which enters the mixture of ice and water, while the other end projects into the air. The quantity of ice that is melted by the heat given off from the body is not directly observed, but is inferred from the change in volume of the ice-and-water mixture, as indicated by the motion of an index drop of mercury in the capillary tube; it being known that ice upon melting contracts by about $\frac{1}{11}$ of its own volume.

The specific heat of a gas is defined in precisely the same way as the specific heat of any other body; but in the case of gases it is necessary to specify the way in which the change of temperature of the gas takes place. Thus we may heat a gas while we maintain its pressure constant (permitting the volume to increase as much as it will), or we may heat it while its volume is kept constant (the pressure meanwhile increasing). The specific heats obtained under these two different conditions are quite different in numerical value, and they are distinguished respectively, as the "specific heat at constant pressure," and the "specific heat at constant volume." The specific heat of a gas at constant pressure may be determined with considerable accuracy by causing a stream of the gas to flow through a calorimeter, so that it experiences a definite fall in temperature in its transit. The quantity of heat given up by the gas can be made to be very considerable (and hence easily measurable) by continuing the flow for a sufficient time; and to determine the specific heat at constant pressure, we then have merely to divide the total quantity of heat given out by the gas, by the total mass of the gas that has been passed through the calorimeter, and again by the fall in temperature that the gas has experienced. The specific heat at constant volume is more difficult to obtain, and it has usually been determined by an indirect method, rather than by direct measurement. It can be determined directly, however, and apparently with very considerable precision, by means of the Joly steam calorimeter.

Following are the specific heats of a number of substances; though it must be remembered that many of them are more or less uncertain, not only because they vary (in the case of solids) from one specimen to another, and from one temperature to another in all substances, but also because in their determination the thermometric and calorimetric work has unfortunately not always been beyond reproach.

TABLE OF SPECIFIC HEATS.

Aluminum	0.2122
Antimony	0.0486
Borax	0.252
Bromine (liquid)	0.1071
Carbon (diamond)	0.113
" (charcoal)	0.194
Copper	0.0933
Gold	0.0316
Iron	0.112
Lead	0.0315
Magnesium	0.245
Mercury	0.0335
Nickel	0.109
Phosphorus	0.170
Platinum	0.0323
Silver	0.0559
Sulphur (freshly melted)	0.184
Tin (cast)	0.0559
Zinc	0.0935
Ice (at 0° F.)	0.504
Alcohol	0.65
Chloroform	0.235
Ether	0.54
Carbon disulphide	0.24
Air	0.2375
Oxygen	0.2175
Nitrogen	0.2438
Hydrogen	3.4090
Carbon dioxid	0.2163
Ammonia gas (NH_3)	0.508
Methane	0.593

In the foregoing table the results given for gases are the specific heats at constant pressure.

Consult Ganot, 'Elementary Treatise on Physics,' and Preston, 'Theory of Heat.'

A. D. RISTEEN, PH. D.,
Editorial Staff, 'Encyclopedia Americana.'

Spectacled Bear, the bear of the South American Andes. See BEAR.

Spec'tacles, a well-known and invaluable optical instrument supposed to have been invented by Roger Bacon in the 13th century, and used to assist or correct some defect in the organs of vision. Spectacles consist generally of two oval or circular lenses mounted in a light

Digitized by Google

metal frame which is made up of the «bows,» «bridge,» and «sides.» The lenses are usually bi-concave, bi-convex, or concavo-convex, though lenses forming segments of a cylinder are used in some cases of astigmatism. In long-sighted persons the defect of the eye is counteracted by convex lenses, in short-sighted persons by concave lenses. See SIGHT.

Divided spectacles have each lens composed of two semi-circles of different foci neatly united one above the other; one half for looking at distant objects, and the other for examining things near the eye. Another kind, called periscopic spectacles, has been contrived in order to allow considerable latitude of motion to the eyes without fatigue. The lenses employed in this case are either of a meniscus or concavo-convex form, the concave side being turned to the eye. See also LENS.

Spectator, The, a name borne at different times by two London periodicals. The first was founded by Joseph Addison (q.v.), and Sir Richard Steele (q.v.), and was issued daily, its initial number appearing 1 March 1711. It was discontinued 8 Dec. 1712, but was issued again from 18 June 1714 to 30 Dec. 1714, its last issue completing 635 numbers. It consisted entirely of essays, contributed chiefly by Addison and Steele and achieved a wide popularity, its wit and sparkling criticism making it a welcome daily visitor.

The modern 'Spectator,' published weekly, was founded by Robert Stephen Rintoul, its first number appearing 6 July 1828. It was designed to be a model of journalism and the first plan was to keep it entirely free from politics. This however, proved impracticable and the 'Spectator' presently came out in vigorous advocacy of reform. For 30 years Rintoul conducted the paper, placing it in the foremost rank and making its influence felt in the discussion of every important reform whether social, political, or religious.

In 1861 the 'Spectator' became the property of Meredith Townsend and Richard Holt Hutton (q.v.), the former taking charge of the political department, the latter that of literature. Their policy in favoring the United States government during the American Civil War when public opinion in England strongly favored the Confederacy did much to impair the home popularity of the journal, but the editors persevered in their course, and the collapse of the rebellion witnessed a change of public opinion which gained for the 'Spectator' an appreciable triumph. The tone of the paper continued unchanged until the death of Hutton in 1897, the policy of the editors being the reverse of modern methods in that they made the columns of their paper a medium for the expression of their personal opinions. Its policy is liberal though not radical, and it has come to be considered the best organ of contemporary thought. Townsend still continues its editor.

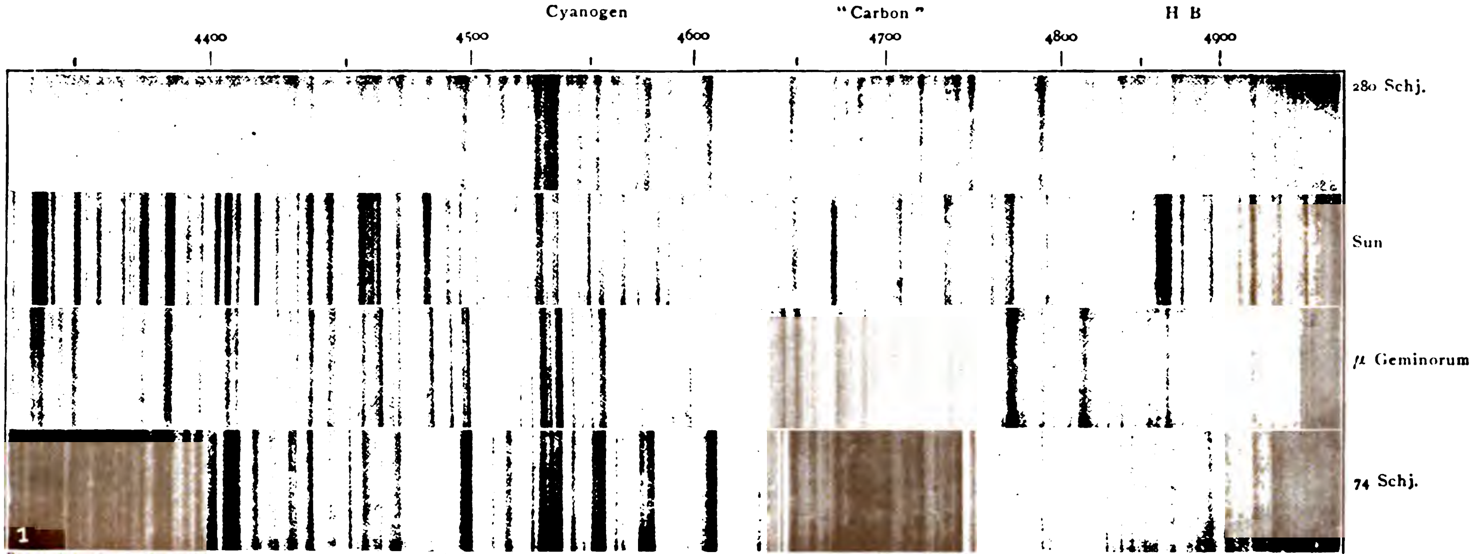
Spectrom'eter, a word used in somewhat different though allied senses. It has been applied to a micrometer or other apparatus applied to the eye-piece of a spectroscope for measuring the position of the lines. But it is now often used as a substitute for spectroscope, the word being applied to that better class of instruments which are fitted up for measuring and determining with great exactness the position of the lines in the spectra examined and the qualities of prisms as regards refractive and dispersive power.

Spec'troscope, the instrument employed in spectrum analysis. See SPECTROSCOPY.

Spectroscopy. If one observes a Bunsen flame through an ordinary glass prism held close to the eye he will see a succession of colored images of the flame. This series of colored images is called the spectrum of the flame. An instrument, such as the prism, which will separate the various radiations emitted by any source of light is called a spectroscope. Spectroscopy is, therefore, defined as that science which has for its object the determination and description of the various radiations which different bodies emit, reflect, and absorb. The subject is here treated under seven headings as follows: (1) Preliminary, concerning the Nature of Light; (2) Sources of Radiation; (3) Separation of Radiations; (4) Methods of Recording Radiations; (5) Comparison and Interpretation of Radiations; (6) Summary of Principles; (7) Bibliography.

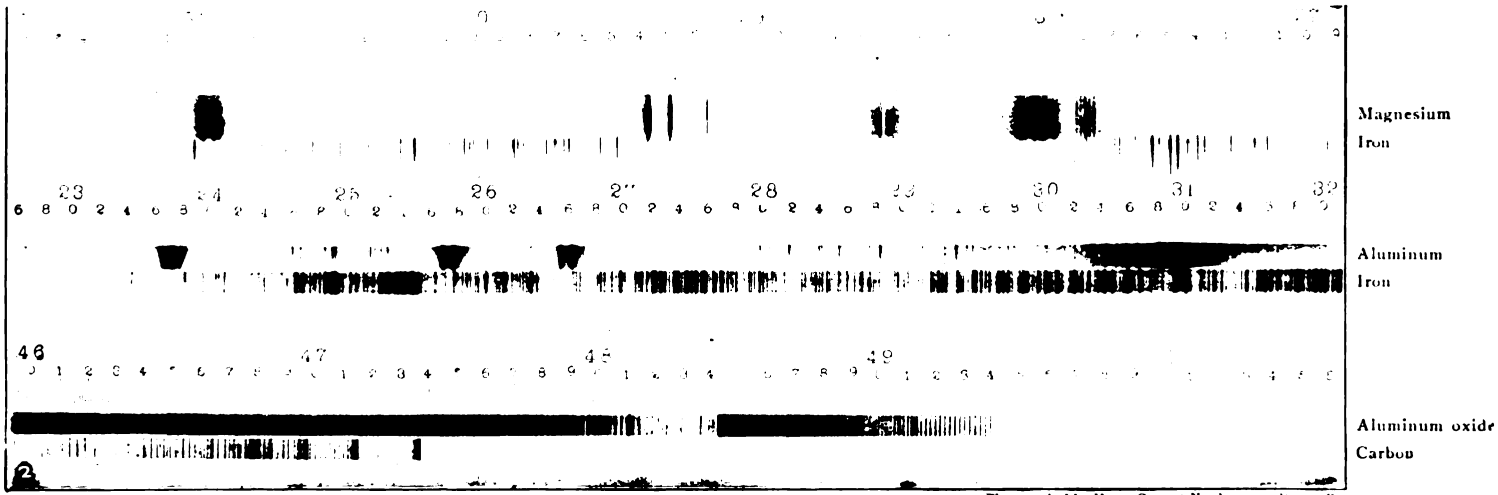
1. NATURE OF LIGHT.— Present views concerning that form of energy which we call light are based almost wholly upon experimental evidence furnished by Huygens, Newton, Young, and Fresnel. Since light is the subject-matter of spectroscopy, it is essential, at the outset that we should understand the modern theory of light as perfected by these four men. Huygens, by assuming that light consists of a wave-motion in the ether, showed that on simple dynamical principles, reflection, refraction, and the finite velocity of light might be easily explained. He first interpreted for us the physical constant known as the «refractive index,» suggesting that for any medium it is merely the ratio of the speed of light in air to the speed of light in that medium. To Newton we owe two capital discoveries concerning the nature of light. In 1666 he demonstrated experimentally that white light contains all the colors of the rainbow, that the simple prismatic colors obtained by analyzing white light cannot be farther separated into other colors by passing them through prisms, and that color, in general, is merely white light from which has been removed some of its colored constituents. Besides this Newton established the fact that these luminous disturbances (which he thought of as moods of easy and of difficult transmission, but which we now call light-waves), are not irregular pulses, as Huygens imagined, but are periodic in character. This inference is drawn from the phenomenon known as «Newton's Rings.» We come next to the work of Thomas Young (1773–1829) who first demonstrated the fact that, under proper conditions, two rays of light, that is two trains of light-waves, may interfere in such a manner as to produce darkness. Young's explanation of diffraction, however, proved to be utterly insufficient, and for the phenomenon of polarization he could offer no explanation whatever, for the reason that he conceived light-waves to be longitudinal and not transverse vibrations. To summarize Young's work most briefly would be to say that he introduced into optics the principle of interference — or of «non-interference,» as suggested by Michelson, since the principle con-

Digitized by Google



By permission from "Decennial Publications," vol. VIII, University of Chicago.

Photographed by Hale, Ellerman and Parkhurst, at the Yerkes Observatory.



Photographed by Henry Crew at Northwestern University.

1. Stellar Spectra.

2. Spectra of Metals.

Digitized by Google

Digitized by Google

sists merely in the fact that of two light rays meeting at a point each produces its own effect independently of the other. Fresnel (1788–1827), in a certain sense, perfected the wave-theory of light by combining the principle of Huygens with the principle of interference and by introducing the idea that light-waves, unlike sound-waves, are tranverse disturbances. Evidence for this view lay in the fact that light can be polarized. We may now summarize the labors of these four men by saying that experiment seems to indicate that light consists in a transverse wave-motion in a medium which pervades all known space and which we call the ether. In space devoid of ordinary matter light of any color travels with a speed of approximately 300 million metres per second, while in all ordinary matter light travels with less speed, the amount of diminution becoming greater and greater as we pass from the red to the violet.

Bearing in mind this conception of a train of light-waves, we proceed to consider the general method of spectroscopy. The examination of a body by means of the spectroscope includes, in general, four steps. These are

A. The Production of the Radiations.
B. The Separation of the Radiations.
C. The Recording of the Radiations.
D. The Comparison and Interpretation of the Radiations.

We shall in the following four sections consider these four steps.

2. Sources of Radiation.— In practice the spectroscopist is limited to two artificial sources, namely, flames and electric currents. Besides these are many natural sources such as lightning, the aurora borealis, meteors, stars, glowworms, etc.; but the nature and occurrence of these natural phenomena are so far beyond our control that they do not here call for discussion. Adopting the following classification,

- Sources
  - Natural
    - Lightning,
    - Stars, including the sun,
    - Comets,
    - Auroræ,
    - Meteors,
    - Glowworms,
  - Artificial
    - Flames
      - Candle,
      - Alcohol,
      - Bunsen,
      - Oxy-hydrogen
    - Electric currents
      - Arc,
      - Brush discharge,
      - Spark,

we now proceed to a description of some particular artificial sources.

Candle and Alcohol Flames.— These have mainly a historical interest, as being the first sources in which line spectra were observed. The temperature of the alcohol flame is only roughly known, but is probably not far from 1,300° C. Substances are easily introduced into the flame and the flame itself is fairly colorless. These two qualities combined to make it very useful in the early history of the science.

Bunsen Flame.— The flame which Bunsen devised in 1856 has three marked advantages as a spectroscopic source, namely, it is simple in construction and operation; its outer mantle is almost totally devoid of any characteristic spectrum of its own; and it possesses a high temperature. Many measurements of the temperature of this flame have been made, but there is good reason for believing that nearly all of these are under-estimates. The most reliable measurement is probably that of Weggener, at Berlin, who obtained 1,788° C. for the outer mantle. The temperature of the violet mantle is probably about 100° or 200° less; while the temperature of the inner dark cone ranges from 250° to 500° C. The substance whose spectrum is desired may be introduced into the flame in a great variety of ways. Bunsen used a bead of the material on a platinum wire; sometimes a piece of asbestos is convenient; Gouy uses the spray from an atomizer; Eder and Valenta have employed a platinum wire-gauze wheel to transport the solution from a dish to the flame.

Oxyhydrogen Flame.— This flame is also nearly colorless, has an exceedingly high temperature and gives spectra approximating those obtained in the electric arc. It has been used with great skill by W. N. Hartley.

Electric Arc.— This source has been in common use since the invention of the Gramme dynamo, 1876. The arc is generally used in one of two ways, either by drilling holes in the carbon rods and filling these holes with the material whose spectrum is desired, or by making the electrodes directly and entirely out of the substance which is being studied. This latter method is, of course, practicable only in the case of materials which conduct electricity. The temperature of the carbon arc is not accurately known, but probably lies between 3,500° and 3,900° C. As a spectroscopic source it is admirable in nearly every respect except that in those regions of the spectrum which are most easily studied carbon has a strong spectrum of its own which is always superposed upon that of the substance under investigation. In the case of metals, the easiest method of avoiding this difficulty is to use a rapidly rotating metal disk for one electrode and a metal rod for the other. The incandescent metal vapor thus obtained yields the purest spectra known.

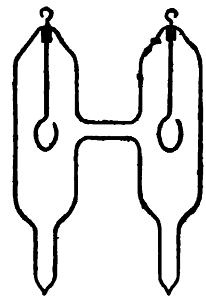


Fig. 1.— An "end on" tube. Shows one form of tube recently employed by Michelson, in which the discharge is viewed from the end, rather than the side of the tube, and which is known, therefore, as an "end on" tube.

Electric Spark.— Of all sources of radiation that which is most generally convenient and most widely used is perhaps the electric spark, obtained by use of an ordinary induction coil. Spark discharges may also be obtained from an electrostatic machine, such as the Wimshurst, from a Tesla coil, or even from a high voltage storage battery. In general the electric spark produces two spectra, namely, the spectrum of the electrodes and the spectrum of the air or

Digitized by Google

other gas between the two electrodes. But, as was discovered by Plücker in 1858, the spectrum of the electrodes may be avoided by enclosing them in a partial vacuum. Under these conditions one gets only the spectrum of the surrounding gas; so that now the almost universal method of studying the spectra of gases is to seal platinum electrodes into a glass tube and then fill the tube under low pressure with the gas to be studied.

The converse problem of getting the spectrum of the electrodes, without that of the surrounding gas, has been solved by Demarcay, Schuster and Hemsalech, who have proved that practically all the «air lines» of a spectrum may be eliminated by placing in the discharge circuit a proper amount of inductance. In this manner the discharge is prolonged and is made to resemble that of the arc.

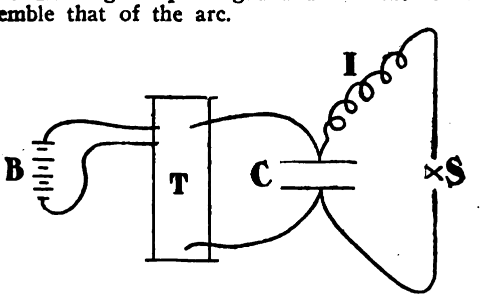


FIG. 2.— Circuit for spark discharge. Illustrates a typical discharge circuit. T is an induction coil or high voltage transformer. The primary circuit is operated by a battery, B, or some source of alternating current.

The electrodes are connected in series with an inductance I, and in parallel with a capacity C. Concerning the temperature of the spark very little is known. It has been generally assumed to be very much higher than that of the electric arc: but there is no direct evidence for this view and there is much indirect evidence against it.

3. SEPARATION OF RADIATIONS.— Let us suppose that we now have before us one of the above-mentioned sources whose spectrum it is desired to examine. The next step will be to separate the rays of various wave-lengths so that we may examine them independently. The reader may here assume that each different substance introduced into the flame or arc gives a different spectrum, peculiar to itself; for this is the experimental basis of spectrum analysis. This analysis is usually accomplished either by passing the light through a prism or by allowing it to fall upon a diffraction grating.

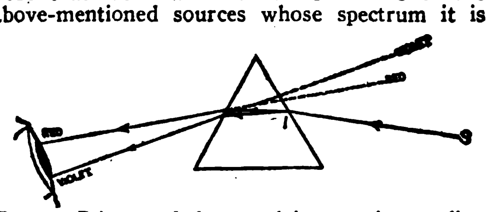


FIG. 3.—Prism used for examining a point- or line-source. [This figure is taken from Crew's 'Elements of Physics,' published by Macmillan Co., New York.]

The Prism Spectroscope.— If the source of light be small and if it is necessary to make only a hasty visual examination, the most convenient plan is simply to view the source through a prism, placed immediately in front of the eye, as indicated in Fig. 3.

This is an especially useful method in observing the discharge in the capillary portion of a vacuum tube. The chief difficulty in the naked prism is that the source, however small, is generally still so large that the successive colored images formed by the prism will overlap each other, leaving the separation incomplete. To avoid this difficulty a small telescope — called a collimator — is placed between the prism and the source as shown in Fig. 4. In the principal focus of its objective is placed a narrow, straight slit with movable metal jaws. The source is now placed immediately back of this slit, or the image of the source is focused upon the slit by means of a lens, called the image lens.

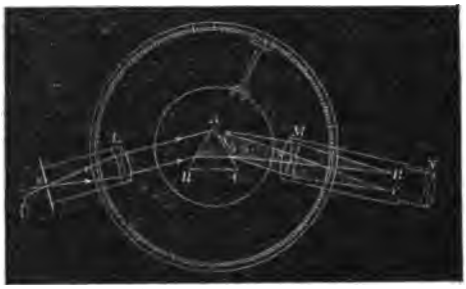


FIG. 4.—Diagram of spectroscope.

When the slit is properly placed and illuminated the collimator will emit from each point of the slit a beam of nearly parallel light whose cross-section is equal to the effective aperture of the objective. If now this emergent beam be examined through a prism and the naked eye as before, a series of colored images of the slit will be seen, each appearing to be at an infinite distance from the observer; and if the slit is narrow these images will be sharp and fine and easily separated. But they will not, in general, appear very bright because the aperture of the human eye is too small to admit more than a fraction of the emergent beam. Accordingly these colored images, each at an infinite distance, are viewed through a small astronomical telescope, called the view telescope. This serves to condense the entire beam which emerges from the prism and reduce it to another parallel beam just large enough to fill the aperture of the average human eye. When it is desired to photograph a spectrum the view telescope is removed and is replaced by a camera with a photographic objective. Such an instrument is known as a spectrograph and an excellent modern form of it is illustrated in Fig. 5.

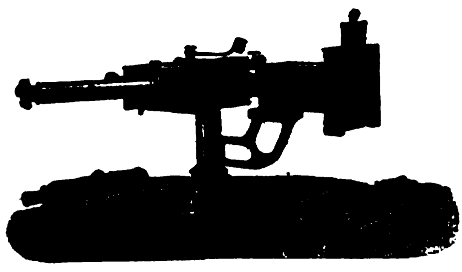


FIG. 5.— The Spectrograph. [This figure is taken from the optical catalogue of Steinheil in Munich, Germany.]

Digitized by Google

When the typical spectroscope, represented in Fig. 4, is provided with a graduated circle, and so arranged that the view telescope and the prism can rotate about the axis of the divided circle, the instrument is known as a spectrometer, and can be employed for the measurement of prism-angles and wave-lengths as well as for the examination of spectra. In this type of spectroscope it is nearly always necessary for the sake of good definition to place the prism in such a position that it will produce a minimum deviation in the incident pencil of rays. For it is proved in geometrical optics that a homocentric pencil will remain homocentric after passing through a prism only provided the prism is placed in its position of minimum deviation. If the prism be set in any other position the image of a point-source will not be a point, but a line.

Resolving Power of a Prism.— If one had a prism spectroscope which was practically perfect so far as all the optical parts are concerned, he would yet find that the ability of the prism to separate light-waves of different lengths was subject to still another limitation — a limitation which arises ultimately from the fact that light-waves have an appreciable length. This ability to separate radiations is known as "resolving power" and is measured by the ratio $\frac{\lambda}{\delta\lambda}$ where $\delta\lambda$ is the difference of the wave-length and λ the mean wave-length of two spectral lines which can just be resolved by the dispersion piece in question.

Rayleigh has proved that a prism can just resolve two lines when the difference of their refractive indices $\delta\mu$ is given by the following equation $\delta\mu = \frac{\lambda}{t_2 - t_1}$ where t_2 and t_1 are the thicknesses of glass traversed by the extreme rays on either side of a parallel beam passing through the prism.

If now $\delta\mu$ be expressed in terms of $\delta\lambda$ by means of a dispersion formula such as the following due to Cauchy we have

$$\mu = A + \frac{B}{\lambda^2}, \text{ and } \delta\mu = \frac{2B.\delta\lambda}{\lambda^3}$$

where A and B are constants depending upon the kind of glass employed in the prism.

From these it follows that the resolving power, R, for a prism is

$$R = \frac{\lambda}{\delta\lambda} = \frac{2B(t_2 - t_1)}{\lambda^3}$$

This equation is fundamental in describing the spectroscopic value of a prism. It means that the resolving power varies directly as the width of the prism and inversely as the cube of the wave-length of the light examined. It tells us also just how thick a prism of any given glass must be, at its base, in order to separate two lines having a given difference of wave-length. The prism spectroscope was first effectively used by Fraunhofer (1817–28); but it was not until 1859 that Kirchhoff and Bunsen demonstrated the power of the instrument in chemical analysis, and in a study of the sun's physical condition.

The Grating Spectroscope.— So far as its auxiliary parts are concerned this piece of apparatus is very like the prism spectroscope: but as regards its essential feature, the dispersing piece, the two instruments are radically different. For the dispersion which is produced by a prism rests ultimately upon the fact that waves of longer length travel through glass at a higher speed than those of shorter length: while the dispersing effect of a grating is due to the fact that when waves of different lengths are forced to pass through a narrow opening, they are all spread out like a fan — diffracted — the longer waves being more spread out, however, than the shorter ones. If a gas flame, turned low, or an incandescent electric lamp be examined through a single narrow slit in a visiting card, a number of spectra will be seen on each side of a central bright image. These have been called, by Fraunhofer, "spectra of the first class." They are *not* used in spectroscopy. If, however, the same source of light be viewed through two or more fine parallel equidistant slits, placed close together, say less than 1-64 inch apart, another series of spectra will be observed. These are the combined effect of light passing through several openings; they are known as "spectra of the second class" and are practically the only ones used in the grating spectroscope. These narrow equidistant parallel slits were first prepared by Fraunhofer (1821) who formed them by wrapping fine wire over the thread of two parallel screws, then soldering the wires to the screws and cutting away one entire side of the little cage thus formed. Such a device he called a grating. The modern grating is made by ruling straight lines with a diamond point on a flat plate of highly polished speculum metal. Good gratings have usually from 5,000 to 20,000 lines per inch. Here the light is reflected from the unruled surface between two successive furrows made by the diamond; and diffraction occurs exactly as if the light had passed through a narrow aperture of the same width. Such a device is called a reflection grating, and when placed where the prism stands in an ordinary prism spectroscope we have what is called a grating spectroscope.

When a beam of parallel rays emerges from the collimator and falls upon a grating placed with its rulings parallel to the slit of the collimator, part of the light is reflected according to the laws of ordinary reflection and forms, in the focal plane of the view-telescope what is known as the central image. The remainder of the light, however, is spread out on either side of this central image, the blue light being deviated least and the red light (longest waves) being deviated most. Unlike the prism the grating yields several spectra distributed on each side of the central image.

If monochromatic light be viewed with such an instrument a series of bright lines — sharp maxima — each an image of the slit will be seen distributed on each side of the central image. The image nearest the central one is said to be of the "first order," the next of the "second order," etc. The properties of these images and of diffraction spectra, in general, are most briefly described by the following three equations, which follow directly from the wave theory of light

$(a + b)$ $(\sin i + \sin \theta) = m\lambda$ . . . (Eq. A).

Here $a + b$ is the distance between corresponding points on two consecutive rulings

Digitized by Google

— the so-called grating constant. The angle of incidence is denoted by i; the angle of diffraction by θ; the order of the spectrum by m, and the wave-length by λ. This equation tells us exactly in what position, θ, we must set the view-telescope in order to observe a line of any given wave-length. Conversely it enables us to compute the wave-length when once we know the grating constant and the directions of the incident and diffracted rays.

$$I = I' \frac{\sin^2 \frac{n\mu(a+b)}{2}}{\sin^2 \frac{\mu(a+b)}{2}} \quad . \; . \; . \; . \; . \; . \; . \; . \quad \text{(Eq. B).}$$

Here I is the intensity of the spectrum of a monchromatic source of wave-length λ in any given direction, produced by a grating which has n lines ruled upon it at a uniform distance, $a+b$, apart.

I' is the intensity which a single aperture would give in the same direction. The "given direction" is here defined by μ whose value is

$$\mu = \frac{2\pi}{\lambda} (\sin i + \sin \theta)$$

the symbols having the same meaning as in Eq. A.

It is important here to observe that Eq. A merely defines the directions in which I of Eq. B reaches its principal maxima.

Lord Rayleigh has shown that the resolving power of a grating, R, is defined by the following simple expression:

$$R = \frac{\lambda}{\delta\lambda} = mN \quad . \; . \; . \; . \; . \; . \; . \; . \; . \quad \text{(Eq. C)}$$

where N is the total number of rulings on the grating and m is the order of spectrum employed.

All of the best gratings of the world up to the present time (1904) have been ruled on Rowland's dividing engine at Johns Hopkins University. Most of these gratings are ruled with from 5,000 to 20,000 lines per inch; some of them have a ruled surface six inches in width, thus giving a resolving power of no less than 400,000 in the fourth-order spectrum. Such a resolving power is far in excess of anything attainable with prisms of practicable size.

Concave Grating Spectroscope.— Recent advances in spectroscopy are due in a very large degree to the invention of the concave grating by Rowland in 1883. The distinguishing features of this instrument are that it requires no collimator and no view-telescope, and that it gives spectra which are normal throughout a large range. The ruling is upon a concave spherical mirror of speculum metal, the distance between the lines being equal when measured along a chord. It was with a spectrograph of this type that Rowland and Higgs each prepared his superb atlas of the solar spectrum. The same kind of grating was also employed by Kayser and Runge in their profound study of the spectra of the elements.

The Echelon Spectroscope.— Measured by resolving power, the Echelon, devised by Michelson in 1898, is a still more effective instrument. This is essentially a grating with only a few rulings in which the form of the groove is under perfect control. This result is obtained by using a pile of plane parallel plates of equal thickness, the edge of each plate being slightly displaced over that of its preceding neighbor. The high resolving power is obtained by use of spectra of high orders, even as high as several thousand. The Echelon is especially adapted to the separation of the close components of a spectral line, as in the case of the Zeeman effect.

The Interferometer.— Another device for separating the close compounds of what is ordinarily called a single spectral line is the interferometer, which is also largely due to Michelson. It is this invention which makes it possible to use the wave-length of the red cadmium ray as a standard of length instead of the international metre at Paris; for Michelson has shown that by the interferometer he can measure wave-lengths with an accuracy of one part in a million.

4. Methods of Recording Radiations.— Having separated the different lines in any spectrum, the next step, in general, is to record the intensity, position (wave-length), and physical character of each of these. Just how this is accomplished will depend partly upon the portion of the spectrum under examination and partly upon the purpose of the work. If the physical character of a line be the matter in question, a glance of the eye may be sufficient to determine it or it may require an elaborate investigation by means of the interferometer, according to the detail and accuracy required. To record the position of a line within one Angstrom unit is ordinarily the work of a few minutes; but to measure a wave-length with an accuracy of 0.01 Angstrom unit demands skill of the highest order and plenty of time. In general, however, it may be said that in the ultra-violet region, say from λ4,000 to λ1,000 photography is practically the only available means for obtaining a record. In the visible portion, say from λ8,000 to λ4,000 the eye and the photographic plate are each available. By photography Abney has recorded wave-lengths as great as 27,000 Angstrom units.

In the infra-red region, that is for wave-lengths greater than 8,000, the bolometer, the radiomicrometer, the radiometer, and the linear thermopile have all been used to good purpose. Rubens employing a linear thermopile has pushed his measures to λ61,000. But photography is probably more used than all other methods put together.

5. Comparison and Interpretation of Radiations.— Let us suppose that the lines in the spectrum of a certain body have been analyzed and recorded, it may be only for the moment on the retina of the eye, it may be permanently upon a photographic plate. The next step is to apply this information to the purpose for which it was obtained. To this end, the observer generally makes one of the five following comparisons:

(a) A comparison of the spectrum in question with itself when the radiation is produced under different conditions. Thus by comparing the ordinary spectrum of the sodium flame with that of the same flame in a strong magnetic field the Zeeman effect was discovered. By comparing spectra of the same star taken at short intervals of time Pickering discovered a new class of double stars called "spectroscopic binaries."

Digitized by Google

(*b*) A comparison of the spectrum in question with the spectra of other bodies. Thus a spectrum of iron, placed alongside the solar spectrum of the same scale, convinces one that there are many lines in the two spectra which coincide in position; and that therefore iron is probably one constituent of the sun.

(*c*) A comparison of the spectrum in question with some spectrum predicted by theory. Thus Keeler established Maxwell's view of the constitution of Saturn's rings by comparing the spectrum of these rings with the spectrum predicted by Doppler's principle.

(*d*) A comparison of the spectrum in question with the same spectrum recorded in other ways. Thus Lewis compares the infra-red spectra of sodium as obtained from the photograph, the phosphorograph, the bolometer, the radiomicrometer, with that predicted by Kayser and Runge's formula.

(*e*) A comparison of the spectrum in question with a standard scale of wave-lengths, that is, with an ideal spectrum in which each line differs from its nearest neighbor by exactly one Angstrom unit. The most beautiful examples of this comparison are to be found in the maps of the solar spectrum prepared by Rowland and by Higgs.

Concerning the interpretation of spectra, it must be frankly admitted that this is the most difficult part of the entire subject, demanding as it does wide experience in the laboratory and judgment of the highest order. Apparently no theory is so fanciful but it may find some support among the varied and complex phenomena presented by the spectroscope. The science of optics is controlled by a well-established theory, while spectroscopy must still be classed as an almost purely empirical science.

6. SUMMARY OF PRINCIPLES.—There are, however, some general principles which have been fairly well established: Following are the more important ones:

Spectra of Gases.—The emission spectrum of a gas can be obtained, in general, only by passing an electric current through the gas. The emission spectrum of a gas is practically always a spectrum of bright lines. The emission spectra of solids and liquids are practically always continuous. As illustrating exceptions to this general law, may be cited the fact that Paschen using the bolometer has obtained the characteristic radiations of carbonic acid gas heated by streaming through a hot platinum spiral; also the fact that the spectra of gases under very high pressures become nearly continuous.

Kirchhoff's Law.— Let us denote by H the amount of radiant energy, say heat or light, of any one wave-length which falls upon a body at temperature t° in one second. Let h denote the energy of the same wave-length which this body absorbs in one second when at the same temperature. The ratio h/H is what Kirchhoff calls the «absorption» of the body, and is denoted by A. A body which absorbs all the heat falling upon it is said to be «absolutely black»; its absorption is unity. Let us now denote by E the amount of energy of the same wave-length which this same body would radiate in one second. This quantity is called the «emission» of the body. Now Kirchhoff, in 1859, proved that

(1) The ratio of the emission to the absorption of any body depends upon the temperature only; and

(2) This ratio is numerically equal to the emission of an absolutely black body at the same temperature.

By means of these two general principles Kirchhoff was enabled to explain the fact that a sodium flame placed between one carbon pole of an electric arc and the slit of the spectroscope will produce two dark absorption lines in the orange of the continuous spectrum exactly where, without the arc, it would produce two bright lines. But what is more important, Kirchhoff succeeded in explaining, on these same principles, the dark lines which Fraunhofer mapped in the spectrum of the sun. The continuous part of the solar spectrum is supposed to be due to the central fluid or solid part of the sun; while the dark lines — the so-called Fraunhofer lines — are due to absorption of the cooler gases which surround the sun. In the same manner may be explained the dark lines which appear in nearly all stellar spectra.

Doppler's Principle.— It we denote by v the speed with which any radiant source is approaching the observer, by V the speed of light, and n the number of waves of length λ emitted per second by the source, then it is evident that the n vibrations which the source emits in any one second will be distributed over a distance numerically equal to $V-v$. Hence the wave-length of the light, λ, which reaches the observer will be

$$\lambda = \frac{V-v}{n} = \frac{V}{n}\left(\frac{V-v}{V}\right) = \lambda_0\left(\frac{V-v}{V}\right).$$

It is evident, therefore, that the wave-length of light coming from a star which is approaching the observer will be shortened in the ratio $\frac{V-v}{V}$. In like manner, if a star be receding from the spectroscope the wave-lengths will be increased in the ratio $\frac{V+v}{V}$. This principle, first enunciated by Doppler in 1843, enables the astrophysicist to measure rates of approach and recession. Recent work by Frost and Adams shows that the speed of a star in the line of sight can be determined with an error not exceeding one half mile per second. In like manner the relative motion of the two limbs of the sun, and hence its period of rotation, has been determined by the spectroscope.

Effect of Pressure.— In 1895, it was proved by Humphreys and Mohler, from measurements made in the physical laboratory of Johns Hopkins University, that the wave-length of a line in the spectrum of any element is dependent upon the pressure of the medium surrounding the source. Thus when the cadmium arc is worked under a pressure of 10 atmospheres the cadmium lines are shifted toward the red end of the spectrum about 0.07 of an Angstrom unit. In general, the amount of this shift is toward the red, directly proportional to the wave-lengths in any one element, and directly proportional to the excess of pressure above one atmosphere.

Effect of Atmosphere Surrounding Source.— It has been shown by Crew, Basquin, Porter and Hartman that the spectrum of an electric arc between two metallic electrodes is very distinctly affected by surrounding it with an atmosphere other than air. In the case of hydrogen, it has been shown that the lines affected by the hydrogen atmosphere belong to the spark spectrum of the metal. It is also true that the lines which belong to Kayser and Runge's series are not affected by the change from air to hydrogen. It has been suggested that this effect may account for the peculiar spectra of many of

Digitized by Google

the so-called "hydrogen stars," that is, stars in which the hydrogen spectrum is very strong.

The Zeeman Effect.—In 1896, Zeeman, then at Leyden, made the capital discovery that if a source of radiation be placed in a magnetic field each individual line in its spectrum will in general become a triplet with the two side components circularly polarized and the middle component plane polarized.

Temperature Effects.—The role which temperature plays in the production of line spectra is very little understood. It is, at present, impossible to say to what extent the various characteristics of flame, arc, or spark, spectra depend upon temperature, upon chemical action, and upon electrical conditions. But in the case of solid bodies, whch yield a continuous spectrum, Stefan showed, in 1879, that the total radiation varies as the fourth power of the absolute temperature. And it has since been established by Wien that, if we denote absolute temperatures by T, $\lambda_m T$ = constant and $I_m = T^5$ constant where λ_m indicates the wave-length at which the radiation is a maximum and I_m represents the value of the maximum radiation. These two important laws are merely inferences from a still more general expression which Wien has established.

Law of Spectral Series.—Soon after the discovery was made that there exist in the spectra of the elements certain series of lines distinguished by certain common characteristics, Balmer succeeded in devising a single formula which gives, in a very exact manner, the wave-length of each of the hydrogen lines known to him at that time. The expression is as follows:

$$\lambda = \lambda_0 \left(\frac{m^2}{m^2 - 4}\right)$$

where λ_0 is a constant and m denotes the natural numbers beginning with 3. This formula has since shown itself competent to describe accurately the 29 hydrogen lines which are now known.

In 1888 Kayser and Runge began a remarkable study of the arc spectra of many of the more important elements and showed that most of these elements contain one or more series of lines capable of representation by the following formula:

$$\frac{1}{\lambda} = A + Bm^{-2} + Cm^{-4}$$

in which *A, B* and *C* are constants for each series, and m denotes the natural numbers beginning with 3. Each different chemical element has its own different characteristic values for these three constants. This fact is the foundation of spectrum analysis.

Rydberg has shown that the following expression is equally effective in representing the facts:

$$\frac{1}{\lambda} = A + \frac{B}{(m + \mu)^2}$$

where *A, B,* and μ are constants for each series, while λ and m have their previous meanings. Thus in the case of *Mg, Zn* and *Cd* there are six such series, in each case equivalent to two series of triplets. It is to be hoped that this great advance will be followed some day by a dynamical explanation of the vibrating atom, which will include these two formulæ as rigidly derived inferences.

Bibliography.—In the way of a general treatise, consult Kayser, 'Handbuch der Spectroscopie' (Leipsic 1900) as incomparably the most complete and scholarly work in existence. Here may be found references to the literature of every part of the subject. For a complete theory of the plane grating consult Rowland 'Physical Papers.' A most elegant and simple theory of the concave grating is given by Runge in Kayser, 'Handbuch der Spectroscopie.' On the general theory of the spectroscope, see a series of papers by Wadsworth in the 'Astrophysical Journal,' Vol. I., *et seq.* An excellent treatise on stellar spectra is Scheiner, 'Astronomical Spectroscopy,' translated into English by Frost (1894). Solar spectroscopy is treated by Young in 'The Sun' (International Scientific Series), and by an important series of papers by Hale running through the 'Astrophysical Journal' from its beginning up to the present, 1904.

HENRY CREW,
Northwestern University.

Spectrum Analysis. See SPECTROSCOPY.

Spec'ulum. (1) In optics and astronomy, a polished surface, usually metallic, for reflecting images. Specula are employed in large telescopes as reflectors. (See TELESCOPE.) (2) In medicine and surgery, an instrument for opening a part or passage of the body, especially for dilating an orifice, and where possible for throwing light within. It is used to facilitate examinations and operations.

Speculum Metal. See MIRROR.

Spedding, spĕd'ĭng, **James,** English editor and author: b. Mirehouse, Cumberland, 26 June 1808; d. London 9 March 1881. He was graduated from Trinity College, Cambridge, in 1831, was long an honorary fellow of his college, from 1835 till 1841 was employed in the Colonial Office, and in 1842 was secretary to Lord Ashburton's mission to the United States for the settlement of the northwest boundary dispute. On the formation of the civil service commission in 1855 he became its secretary. In 1847 he undertook, with the collaboration of R. L. Ellis and D. D. Heath, to prepare a complete edition of Bacon's works; but the former died while the task was unfinished, and the latter only gave occasional assistance. The work, therefore, was almost entirely left to Spedding, who completed and published his labors in 7 volumes (1857–9). This done, he published 'The Life and Letters of Bacon' (1861-74); 'Reviews and Discussions, Literary, Political and Philosophical, Not Relating to Bacon' (1879); and 'Studies in English History' (with J. Gairdner, 1881.) Leslie Stephen has called Spedding's Bacon "an unsurpassable model of thorough and scholarlike editing." Consult the 'Life' by Venables to his edition (1881) of 'Evenings with a Reviewer,' privately printed by Spedding in 1845.

Speech, the production of articulate sounds by the voice organs; it consists in tones of voice modified by the agency of the tongue, cheeks, lips, and other structures intervening between the glottis and the outer opening of the mouth. The modifications of articulate sounds which may be invented and used by man are almost without limit; the modifications actually used in the speech of all mankind numbers at least a thousand, and a universal language would have to

Digitized by Google

provide symbols representative of that many speech sounds. Nevertheless, the number of distinct sounds in any one language seldom exceeds 50. In speech two classes of sounds are produced, known as vowels and consonants. Vowels are pronounced by sounds coming primarily from the larynx; consonants are formed by sounds due to interruption of the currents of air in the mouth or passages above the larynx. The name consonant denotes a sound that cannot be produced effectively without the aid of a vowel. The vowels are further distinguished by the fact that they can be sounded mutely, or in a whisper. The differences between vowel sounds are owing to differences in the dimensions of the space between tongue and palate (mouth cavity) and of the mouth opening, when the vowels are pronounced, as shown in the following table:

Vowel		Sound	Size of mouth-opening	Size of mouth-cavity
a	as	in *far*	5	3
e	as	*ei* in *vein*	4	2
i	as	in *marine*	3	1
o	as	in *cold*	2	4
u	as	*oo* in *moon*	1	5

Vowel sounds can be prolonged indefinitely; so may some consonants, as l, m, n, r, s, z, etc.; but others, as b, p, t, d, k, g hard, cannot be prolonged. Absence of the sense of hearing prevents the perception of sounds and also their imitation — hence persons born deaf are necessarily dumb, but through training such persons may acquire the power of speech. Where dumbness exists without deafness the affection is due to some disorder of the nerve centres.

Speech, Defects of. Speech is an extremely complex and intricate mechanism, and in the normal adult represents a large number of various factors. Its defects therefore are equally complex. In ordinary speech at least three separate types of processes are involved: (1) sensory; (2) motor, and (3) intellectual or associational.

(1) The sensory mechanism of speech includes all the avenues by which the idea of a verbally expressible picture can get into the brain. The eye and the ear are mostly used because with these senses the pictures are most distinct, but touch, smell, or other sense, if recognized, may be of use in the faculty of speech. Thus with the sensory portion of the speech-mechanism the intellectual factor must necessarily be joined. One sees the words on a printed page and pronounces them; but if written in a script to the reader unknown, he can see the characters and yet will not be able to utter the sounds they represent.

(2) The motor side of speech implies (*a*) the ability to use the muscles of speech and (*b*) the power of co-ordinating those muscles so as to say the right things. The lips, the tongue, the larynx, the teeth are the organs mostly used in speech. One may say that in deaf-mutes the hands are organs of speech. The nerves that govern the muscles ordinarily used in speech are the motor cranial nerves, the nuclei of which are located in the medulla oblongata (q.v.); but the centre that co-ordinates their movements with the sensory impressions which come in through the organs of special sense, as well as with the intellectual concepts concerning the things seen, heard, or touched, is located in the third frontal convolution, or Broca's convolution. This is the so-called motor centre for speech.

(3) The intellectual factor in speech implies the action of co-ordinating and associational fibres in the human brain that pass from the sensory centres to the motor centres. It is the factor that governs, as it were, the knowledge of what one is saying. One may repeat from the hearing a line of Choctaw, but without understanding it: the intellectual factor is here non-operative. Memory-images of many kinds may be reproduced by appropriate stimuli; and defects in certain parts of the brain interfering with the bringing out of the memory-images by which a sound is associated with its cause, or an object with its name, occasion certain well-defined disorders of speech. The act of speaking, therefore, requires: (*a*) the power to think or to construct an idea; (*b*) the capacity to recall and to formulate the word or words which express the idea; (*c*) the ability to articulate the sounds in an understandable or conventional manner.

It is customary to use the word aphasia to denominate true defects of speech. Defects in the incoming sensory tracts, which must modify speech in some respects, are not usually included in this category. In the same manner defects in nervous supply of the muscles of speech, such as paralysis of the tongue, are not termed aphasia. Again, a purely intellectual defect, as in idiocy, whereby speech is seriously affected, is not classed as aphasic. Seglas has divided the disorders of speech into three groups: (1) dylogias, or the disorders of intelligence which affect speech — as seen in idiots, imbeciles, etc.; (2) dysphasias, or true affections of speech (aphasias) — the most interesting and complicated; (3) the dysarthrias, or the disorders of articulation — such as are seen in stuttering, in the peculiar speech of deaf-mutes, in the speech of bulbar palsies, of facial paralyses, etc.

The aphasias are the defects of speech that involve the association-tracts and the sense-centres, and have been most exhaustively studied. Speaking generally, the true aphasias may be classed in three broad groups: (1) the receptive or sensory aphasias, which result from some injury to the centres for sense-memories of things heard, seen, smelt, tasted, touched, etc.; (2) the conduction-aphasias, which follow injury to the conducting fibres in the brain that pass from a sense-centre to the motor centre; (3) emissive or motor aphasia, which is produced by an injury to the motor cortex chiefly of Broca's convolution. Some 30 different types of aphasic disorder of speech are known, and may be summarized on the chart here given; but some of the commoner forms of aphasia may be mentioned. Of the receptive or sensory type, amnesic aphasia, or word-deafness, is one of the most characteristic. In all of the sensory aphasias there is a loss of comprehension of the words heard or read. In amnesic aphasia the patient hears very distinctly everything that is said, but it might as well be in a foreign tongue, because of the disorder of the centre for word-memory pictures in the temporal convolution The patient usu-

Digitized by Google

CHART.—(From Langdon, 'Aphasia.')

APHASIA	Receptive or "Sensory"	Auditory aphasias ...	1. Amnesia verbalis (word deafness), the non-recognition of word sounds.
			2. Amusia (music deafness), non-recognition of musical sounds.
			3. Auditory apraxia (object deafness), non-recognition of object sounds.
		Visual aphasias	4. Alexia (word blindness), non-recognition of word meanings. .
			5. Visual apraxia (object blindness), non-recognition of object meanings or uses.
			6. Visual amimia (pantomime blindness), non-recognition of word or pantomime mimicry.
		Olfactory aphasias ...	7. Cortical anosmia (smell memory loss), non-recognition of objects by smell.
		Gustatory aphasias ...	8. Cortical agusia (taste memory loss), non-recognition of objects by taste.
		Myotactic aphasias ...	9. Myotactic alexia (word anæsthesia), non-recognition of word movements by finger or pen.
			10. Myotactic amimia (pantomime anæsthesia), non-recognition of mimicry by touch.
			11. Myotactic apraxia (object anæsthesia), non-recognition of objects felt.
	Conduction, "Associational"	Auditory paraphasia .	12. Paraphasia verbalis (spoken word forgetfulness), non-recollection of word sounds.
			13. Paramusia (musical sound forgetfulness), non-recollection of musical sounds.
			14. Auditory parapraxia (object sound forgetfulness), non-recollection of object sounds.
		Visual paraphasia .	15. Paralexia (word meaning forgetfulness), non-recollection of word meanings.
			16. Visual parapraxia (object meaning forgetfulness), non-recollection of object meanings.
		Olfactory paraphasia .	17. Parosmia (smell memory forgetfulness), non-recollection of smell meanings.
		Gustatory paraphasia .	18. Parageusia (taste memory forgetfulness), non-recollection of taste meanings.
		Myotactic paraphasia .	19. Myotactic parapraxia (object touch forgetfulness), non-recollection of feel of objects.
			20. Myotactic paramimia (pantomime forgetfulness), non-recollection of mimicry movements.
		Concept aphasia	21. Anomia (name memory loss), non-recognition of names of objects.
			22. Paranomia (name forgetfulness), non-recollection of names of objects.
	Emissive, or "Motor"	Spoken	23. Psychic motor aphasia (spoken word construction lost), loss of psychic spoken word plans.
			24. Executive motor aphasia (spoken word utterance loss), loss of spoken word motor memories.
		Written	25. Psychic agraphia (written word construction loss), loss of psychic written word plans.
			26. Executive agraphia (written word utterance loss), loss of written word motor memories.
		Pantomimic ..	27. Psychic amimia (pantomime construction loss), loss of psychic word mimicry plans.
			28. Executive amimia (pantomime utterance loss), loss of word mimicry motor memories.

ally speaks, but makes many lapses, not knowing just what he is saying, and on hearing his own speech not understanding it. Many varieties of this defect are known. They should be studied in special monographs (see chart for varieties). In the conduction or association aphasias, or paraphasias, the association-fibres connecting one speech-centre with another are interfered with. Any of the types may be present, but the form most often seen is one in which the tracts between the auditory centres and the motor speech-centre is involved. Here the patient is aware of the words, knows what they mean, and tries to speak, but speaks incorrectly; his path seems to be blocked. The commoner type is motor aphasia. In this Broca's convolution is affected. The patient here sees and hears and comprehends, but is unable to speak the words. He is likewise unable, as a rule, to write the words he sees or hears, and hence suffers from agraphia as well. Many common expressions, as "yes" and "no," "good morning," "good bye," etc., may be retained. The mechanical necessities that underlie many intellectual processes are clearly brought out in the study of aphasia; and in no other manner is the knowledge driven home how dependent one is on the proper working of certain centres and tracts, as in the study of the defects of speech. Consult: Lichtheim, 'Aphasia, Brain' (1895); Elder, 'Aphasia and the Cerebral Speech Mechanism' (1897); Bastian, 'Aphasia and Other Speech Defects' (1898); Collins, 'The Genesis and Dissolution of the Faculty of Speech' (1898); Pick, 'Proceedings of 10th International Congress' (Paris, 1900); Dejerine, 'Semeiologie des Maladies Nerveuses' (1902); Baldwin, 'Dictionary of Philosophy and Psychology,' article 'Speech and its Defects' (1902–4); Starr, 'Organic Nervous Diseases' (1903).

SMITH ELY JELLIFFE, M.D.,
Editor 'Journal of Nervous and Mental Disease.'

Speech, Origin and Natural History of. Speech began the history of man. Until its advent there was no "man": a Homo alalus is unthinkable. Speech is a thing, appealing to the senses through hearing. It "dropped from the lips of men" and "lived only in memory" — the primitive art preservative. But it not only became a form of communication between man and man, but between one generation and another, handed on from father to son, creating an immortality of mind. It should contain a perfect record of the progress of man, and would

Digitized by Google

do so but for its irreparable losses. As it is, it preserves imperishable monuments of man's ambition, which are only beginning to be discovered. Appealing to the ear, it is a thing of sound, and has a purely physical basis. Evolution accepted, this conclusion is inevitable; demanding not only the unity of race, but also of a primitive speech as the first spark of manhood. Its perfecture is manifest in studying the special features of the organs of speech (see VOICE ORGANS, SPECIAL FEATURES OF). Its sources can be traced and its natural history followed. There is a point to which we can go back, saying, «This was the beginning»; and from which we can retrace our steps. As a result of organized mechanism speech must yield to such treatment. For to man had been «given the protoplasm of the sign making faculty»; so that as Lucretius declared, «Nature impelled man to utter various sounds of the tongue, and use struck out the names of things»: how near the mark! Drummond asserted, «It is not necessary to assume that all words should have a rational origin.» Man's capacity for utterance was inherited: the fundamental gift of nature, voice, was common to the beasts and him. What made the difference between the utterance of the lower animal and man was what made speech. The voices of animals were their articulate cries, monosyllables such as «ha, he, hi, ho, hu» (aspirated vowels) which Monboddo considered «vestiges of savage language, by which, like beasts, man expressed certain emotions, and which he could use as warnings.» As Noire put it, «Man recognizes an object by a characteristic mark. He recognized the goat by its bleating. This was the comprehended token by which the mind clearly hit upon an idea. What else is this than a word?» Evans, in remarking that bleating was represented in the Rig Veda by the word «ma,» thinks «it is probable that in this onomatopoetic expression we come nearer the real origin of the word mother.» But it is this very sound ma that is the birthright of the infant itself. The senseless infant, instinctively impulsed, produces the cry for which humanity born of the mother, was waiting to «give attention.»

The infant is born unconscious: it was the consciousness of the mother that was aroused by it. The sound «ma,» exploded from the impatient lips of the child, was its natural cry for attention, for food. To the fondling mother the word «ma» marked herself; she took it to herself. The cap fitted for all time. This is the fundamental fact of the making of speech — the marking of some recognizable sound, and rendering it significant. It was the primal burst of infancy, which had only sound form, but no born sense. It was the suddenly illumined mind of the watchful hearer, that enwrapped in it the sense, that gave it immortality. This is the germ, nucleus, molecule — the posited beginning — of speech, and all that followed was but its evolution. As the infant grew into consciousness the consent of instinct became the assent of the authors of its being. The babe calling «Ma!» with meaning, did then from its open-mouthed attitude, on the approach of the other parent next to it, by a glide easily turn its «Ma!» into «Pa!» dropping the precious morsel from the same site. The parents, while the child was busy, repeated the words, and called upon the only other possible form they could pluck from the same seat, and launched upon the rhythmic world the word Ba! identifying it there and then with the child. Then a babel of merry sound floated from the «gate of the kiss,» in the laughter of the three, the primitive family. This laughing «Ha! ha!» produced intently gave us the aspirate. Its chorus, with the song of «Ma-pa-ba,» produced the first comedy of three acts, bringing into the world the joy of living and humor beside. It broke the tongue-tied and mind-locked doom of the beast, dispelled the gloom of the past in the light that illuminated the path of man. As the child grew, and became the father of the man, and «baba» became «abba,» so he sprung from time to time new surprises in store for himself in freeing the new mechanical devices awaiting development on the «seats of the mighty.» Hence the crowding upon his mastery of all the simple extensions of the «ma-pa-ba» series to those manageable by other instruments, as he «invented» new modes, with their aid, of expressing his growing relations with things nearest, and things around him. Such simples were the primæ materiæ of speech. And the late Dr. D. G. Brinton fully appreciated them, by giving them the name physonyms to which we are indebted for the creation of the «subsoil» of speech out of which the true radicals of the seed of sense could spring.

The essential of speech, then, is the voice, whose material is breath. The pure voice produces what we also call vowels which are but modifications of a distinctly marked scale, occurring in the passage of the breath forth of its vocal aperture. Articulate speech begins only when the voice has passed through the larynx; the simplest articulation being that which issues unimpeded through the wide-open portals of the mouth as represented by the written symbols ah. This is the mother vowel or voice, its seats the source of sonancy and song; of tone and tune; of euphony and melody. The organ of voice is a wind and stringed instrument. But the greater oratory of speech is the mouth with its orchestra of instruments, upon which the voice, coming in force from behind, further is made to play, producing the grand opera of silver-toned speech. Thoroughly understanding the strict nature of voice — what alone it is and accomplishes, we can understand the real nature of the «movements that go on in the mouth» that set its instruments to work to ennoble the voice and enable it to flow forth in infinite variety of aëriform content. As «mere motions» as Bell has so characteristically termed them, they are, in themselves, voiceless, formless. It is only when they become mated temporarily to voice that they become pronounced. These mere motions are what received the name of consonants: they might with propriety be termed nonsonants; their operation mechanical, merely. To pronounce the name Mtzkhetha, as written, is impossible without drafts of sonancy borrowed from the voice, in the attempt. Without voice, then, there is no sonancy; without the mere mechanical motion (of the consonant) there is no sharp shape, no orotund contour, of voice permissible. The natural endowment of the voice has first to be instrumentalized — before it can be sensed.

These are priceless principles; they point the way to making an abstract of nature's artifices in producing the «elements» of its primitive

Digitized by Google

"alphabet," which, however, was evolved in a different order than that of our ABC. From it what are called vowels might well be omitted, they being naturals. But, for convention's sake, we include them at the head of nature's scheme:

I. The vowels: a, e, i, o, u.
II. The aspirate: h.
III. The instrumentals:

	Primitives	Subsequents
1. Labials	(m), p, b,	f, v, (w)
2. Dentals	(n), t, d,	th, dh; s = z; sh; c, z; j = dsz; ch = tsh.
3. Gutturals	(nk, ng), k, g,	(y = ye).

IV. The imitatives: l, s, r.

Of the above, the vowels and the aspirate have been accounted for; while the subsequents may be eliminated, as of later evolution. Passing over the nasals (m, n, ng) for the moment, we have left p, b; t, d; k, g, of which the birth of the first pair with that of m, has been described. The members of these pairs have sharp explosive as well as tight closing effects — another way of expressing their mechanical operation. They can explode the closed mouth in voice; they can close the open mouth on voice. The mate of each pair is, naturally interchangeable. Besides, the members of each pair are transmutable into others of the subsequents, as a result of more complete command over the delicate mechanism engaged. These facts led to the "discovery" of Grimm's and of Verner's Laws (q.v.). Further, the relationship between the perpendicular members of these pairs is demonstrated by Sweet, "in Ugrian g, d, b, are mere secondary forms of k, t, p."

The nasals (m, n, ng), prolongable and resonant, are of peculiar service, giving the voice-sounds a double-edged effect. But they become at once reduced to the level of the other primitives, as quickly as their passage through the nose is impeded. This explains the "inability to pronounce m": and may also explain what has become a convention among the Mohawk Indians, the entire dropping of the initial m from their speech. "The defect of the stopping of the nose in destroying the work of m causes it to degenerate into b, as in the pronunciation of the modern Jews," and also explains the transformation of m into p.

Nature's scheme shows us the prime value of the imitatives. The instrumentals are "mere motions," the imitatives are much more. Their effect is startlingly true. Speech in gaining this credit required some means of reproducing nature's imperative demand for preservative imitativeness, or reminiscent repetition. Nature accomplished this "phenomenon" with its imitative elements, l, s, r, which are significant, or natural "marks" of sounds of things. The imitatives brought out the first artistry of man, by which he could copy, in his own voice, the tunes he discovered in the hymn nature was producing around him. The principles embodied in this transcript from nature explain the mystery of the Logos: for its logic is irresistible.

Of the imitatives, l, s, r, the latter was the protoform as proved by its interchangeability into the others; which justifies the classification made. R was one of the cardinal virtues acquired by speech: it thrust forth the word to work out its career in the world. The Romans called it the snarling letter: from that to grinding the teeth is but a step; hence the mill-teeth and the molars, the action of which meant a marring, an undoing: mar, to grind, being the universal triturating "radical." We discover it in grinding, stroking, rubbing, rolling, pressing, striking; in war and in Mars.

L is the lingual "letter," produced by the la-la-ing of the babe, by the lul-lul-aby of the mother, early in the tune and croon of infancy. It appears in lollipop, in eating and pronouncing which it is so preoccupied. Rhotacism easily becomes lalation, which licks the rough product of speech into comeliness. It at once became the sensible mark of continuation, therefore of length; of measure, little, ell. As the symbol of habit continued it languishes in law and language. We have lang, leng(th), ling, long, lung, applied in the sense of measure: hence, lank, link, links. Speech is often long-winded, that is lung-winded. Long-tongue is a double: for tongue is what shoots out as a tongue of flame shoots upward in length. Tongue, lingua and dinga, that is, t and l, are shop- or shape-mates, sliding off the same mechanical site. Tongue became ting (thing) and its history must from that be followed in connection with thing. The termination ling (= l + ing), as in darling, is significant of diminutiveness, etc. The tongue seems to lap and lick what it likes. Old gray malkin licks its skin till it is smooth and glistens: and the radical of malkin, is marj, the Sanskrit name for the animal that licks itself, according to Müller.

Sibilation came into vogue with the hiss of the steam of pot-boiling; of the hiss of the serpent; and gave us the hresh (neigh) of the h-r-s (horse). In as and es it represented the breath of life (made apparent as steam on a frosty morning), hence animus, spirit, soul. It appears in east, the point of the rising sun; in easter the time of the rise of sap in spring. Asia is the land of the east, or the rising sun, as was Chorasma, the seething place. Hence asvas, name of the horse, equus, hippos, each, swift or speedy footed. It was the sign of respiration, inspiration, expiration, aspiration. It is significant in hist!, 'ist! for halt! or silence; in stand-still, sit: hence seat, city, civilization. We "lisped in numbers, for the numbers came."

With the possible combinations of ma, pa, ba, etc., carried over to the other sites of the instrumentals and significants; followed by the tricks of the trade of a tongue adept in the art of adopting and adapting; and with the facilities of vowel gradation, with such results as band, bend, bind, bond, bund, not to speak of the interchangeability of the primitives into subsequents, and these into one another, and even the close touch of vowel and consonant, in such results as woo, wool, wood, surely man has given good account of his stewardship of such a precious and delicate organism as he had "bestowed" upon him. He forced his voice through a well equipped mill, where it ground out a grist, upon which he took toll and received his emoluments. The pulverized mill-stuff he kneaded and made o'er anew into more leavened shape: the monosyllable became agglutinated and further milled or inflected. The evolution of speech thus followed physical, physiological and psychological tracks, the physonyms became physyonyms and these psychonyms. The latter development is traceable through instinctive, imitative and significant stages. Where speech is concerned the imitative overlaps, so that we have instinctive-imitative giving place to imitative-significant. The former represents the ground traversed by

Digitized by Google

the naturals and instrumentals, in sound-forms; the latter the ground traversed by the imitatives and significants, in sense-forms. This brings up the synergetic origin of speech.

Thus did man develop his alphabet, not the artificial thing we represent it to be, but a thing of flesh and blood. The Horn-book method of our forefathers is out of date. The natural method in teaching would be to follow nature's way, by beginning the child with what he can most easily pronounce; mating as he went "the sounds he learns to spell with the words he knows so well." Hence m, p, b; and m-a, ma; p-a, pa; b-a, ba, would be the proper order of his limpings into language. Rufus Choate well declared, "We cannot throw the alphabet on the ground and pick up the Iliad."

Speech biologically burst upon the world in demonstrating the elemental sensations. In the infant these were associated with food and protection. Both may be thought of together, speech giving this license: for what is food but alma mater — element, aliment, alimony. The organs first used for securing food were those first used for creating speech — the lips. What man put in his lips he put there by his hand: what came out of his mouth, in speech, was aided by his hand in gesture. Our fathers in their inadvertent attempts at creating an art preservative, represented, in rude carvings (discovered in such widely separated regions as Egypt and America) food as well as speech by the figure of a man's hand bent toward his mouth. Thus nourishment was a hand to mouth existence just as speech was a hand to mouth creation. But the hands and handles of speech were soon entirely removed to the mouth, just as man developed more secure modes of protection and provision. From its dual source speech proceeded: (1) in the expression of the preservation of self (relations of the individual to things around him); (2) in the expression of the preservation of others, in parental care (relations of individuals as a whole to race). The elaboration of the natural history of speech would be along these lines.

The rich vocabulary from the m-p-b instrumentality, and the ma-pa-ba significancy, representing one seat, still yield pristine forms in mam, mab and map (Welsh), now words of family relation, transformable into maban, aban; Ap and Ab, these losing their identity in such names as Price and Bryce. M was the seat of mother and matter; p of paternity and authority and b of babehood and birth (*cf.* bar and ben, in Hebrew). The dental seat gave the primitive forms of man, mate and maid: and the guttural the veritable ing in such as Atheling, and Mong "the mother tribe"; mac = mak, of the same seat, in Gaelic still means "son of" and is equivalent to mag, or mag-u, born or "bred." This seat also furnished karl and girl. Ma was the sign not only of human mother, but of other mothers, and is so used in China to-day, in reference to dog, bird and horse; it is an honorific title, and personal name (General Ma). As sign of the horse it traversed Asia and invaded Europe, becoming marck, in Teutonic and Celtic, and mare in English. These must be considered in the light of the root mar, which Müller shows also meant pounding: hence marck meant the animal that pounded the earth speedily with its hoofs. The mark, bearing his rider forth on his migrations, not only established his boundaries but maintained them: hence the marches, or "borders"; the marks, what were within the marches; and marksmen, Marcomanni, margraves, marquises and marshalls. These ideas are preserved literally in the equivalent phrase "beating the bounds." From mark we have "letters of marque"; marquee, tent of a marquis; marchen, "tales of the borders," and many others. March and marching, originally applied to the tramping of the hoofs of the war-steeds, is now the traversing the ground by the infantry, or foot-soldiers. March, applied to marching or martial music, and the dance, so-called, are explained in the same manner. Mark, a piece of money, was so named because the horse was a medium of exchange, and standard of value, and had its figure stamped on the coin. Thus all other marks!

Names from the primitive lip source for food, meat flesh, are mam, mimz, mamsa. The first aliment was milk and was succeeded by meal and meat, grades from the same "mold": "to milk" and "to mill" were equivalents, the one a stripping of the milk-gland, the other of the meal from the "meal plant," millet (Schraeder): while meat acquired the suggestive sign of the action of the mill-teeth or molars. The mill was a factory of words, such as: emolument, immolation, multure, mulcture, molish, demolish, amulet, multitude, million, mile, molecule, spot, hence immaculate, measles, mackerel: all these by natural gradations of sense, hence for soft, mollify, mollusc, mullet; for tender, mild, mellow; for soft by dissolving, malt, melt, and milt and molten; for sweet, malum, melon, mel (honey), molasses, mellifluous, melody. Mal, the root of meal, then embraced the ideas of time, place, measuring, meeting, marriage (mating), speaking, and speech itself; as in such instances as gemahl, spouse, husband, and Mall, synonymous with Moot and Thing. Meal kneaded into dough became transformed into masse — the pagan origin of Kirmesse, Lammass, Martinmass, etc. We can trace the primitive meal into our various feasts, lovefeasts, banquets, and sacraments: besides other institutions indicated. It was the mother institution. The natural history of speech, in what can be discovered in the sense of its material preserved to us, enables us to trace the pedigrees of words to parental and filial sources. Each word has its autobiography, which leads at length to the primal germ of all.

Bibliography.— Farrar, 'Origin of Language'; Wedgewood, 'Origin of Language'; Bell, 'Visible Speech'; Ellis, 'Natural Alphabet'; Abel, 'Linguistic Essays'; Schraeder, 'Prehistoric Antiquities'; Westermarck, 'Natural History of Marriage'; Chamberlain, 'The Child in Folk-Thought'; Müller, 'Science of Thought,' 'Science of Language'; Oertel, 'Lectures on Language'; Gummere's 'Beginnings of Poetry'; Tarde's 'Laws of Imitation.' See also SCIENCE OF LANGUAGE.

ROBERT C. AULD, F.Z.S.

Speed, James, American politician: b. Jefferson County, Ky., 11 March 1812: d. there, 25 June 1887. He was graduated from Saint Joseph's College, Bardstown, Ky., in 1828, studied law at Transylvania University, and in 1833 engaged in practice at Louisville, Ky. He was elected to the legislature in 1847 and as State senator in 1861 he took an uncompromising

Digitized by Google

stand against the proposed secession of Kentucky. Later he was in charge of recruiting stations in Kentucky. He was appointed attorney-general by Lincoln in 1864 and continued in office until 1866 when he resigned to resume his law practice and his professorship in Transylvania University. He served as delegate to the Republican national conventions of 1872-6, but otherwise held no further public office.

Speed, John, English antiquary: b. Farringdon, Cheshire, 1552; d. London 28 July 1629. He was taught his father's trade of tailoring and in 1580 was admitted to the freedom of the Merchant Taylor's Company. His earlier occupation aside from the practice of his trade was the drawing of maps and in 1608-10 he published a series of 54 'Maps of England and Wales.' These reappeared with descriptive texts as Speed's 'Theatre of the Empire of Great Britaine' (1611) and were subsequently issued in several editions. His next work was 'The History of Great Britaine Under the Conquests of Ye Romans, Saxons, Danes and Normans, . . . with the Successions, Lives, Acts and Issues of the English Monarchs from Julius Cæsar to . . . King James.' This work places Speed as the first English historian in distinction from the annalists and chroniclers of preceding times, but in accuracy the work left much to be desired. He published also 'Genealogies Recorded in Sacred Scripture;' 'A Cloud of Witnesses . . . confirming unto us the Truth of the Histories in God's most Holie Word' (1616).

Speed, John Gilmer, American journalist: b. Kentucky 21 Sept. 1853; d. Morristown, N. J., 2 Feb. 1909. He was graduated from the University of Louisiana in 1869, practised civil engineering for a time, joined the editorial staff of the New York *World* in 1877, was its managing editor 1879-83 and subsequently editor of the 'American Magazine' and 'Leslie's Weekly.' His publications include 'A Fall River Incident;' 'The Gilmers in America;' and 'A Deal in Denver.' He also edited a volume of the poems of John Keats.

Speed. See MECHANICS.

Speed and Sporting Records. The unexpected bursts of wonderful speed that were shown both by the automobile and the horse during the season of 1903 inspired an interest in the lowering of the mile record which afterward became world-wide in its effect. Until the advent of the record-breaking automobile this interest in the mile record had centred largely upon the speed of the horse as compared to that of the man indicated by, what in those days was regarded as one of the speediest methods of locomotion, the bicycle. For years the railroad locomotive had stood alone as the maker of the fastest possible mile, but the coming of the automobile provided a rival which may not improbably succeed at last in reducing the record of even the fastest train In 1894 such a statement would have been regarded as scarcely worthy of consideration, for the «auto» was so largely an object of experiment that speed was regarded as somewhat a minor consideration when compared to the infinite details of workmanship on which the successful manipulation of the machine itself depended. In fact, the fast «auto» is so completely a new century product that it may safely be regarded as doubtful if it has even yet shown the character of speed work of which it is capable. For example, the making of the new records on the Ocean Parkway, Brooklyn, on 16 Nov. 1901, was regarded by experts as being the most sensational speed tests ever held, and it was at this time that chroniclers of automobile progress first dreamed of suggesting that the time might come when the modern automobile would attain a position of perfection that would enable it to show itself a formidable rival to the railroad locomotive.

So far from being a remote possibility, however, the persistent increase in the speed of the automobile has brought its record so much nearer that of the locomotive that they are now separated only by a small fractional part of a minute, and there is no question that, under equally favorable circumstances, even this difference would be partially if not entirely obliterated. The Ocean Parkway, on which the great 1901 records were made, was by no means free of the depressions and projections, that, however insignificant they may seem, communicate themselves so quickly to heavy machines making the enormous velocity of 60 or 70 miles an hour. The Ormond-Daytona course, which is a more perfect track, is undoubtedly the best in America, yet it is not faultless; whereas the specially constructed locomotive engine, running on steel rails, has no such unfavorable conditions to overcome. The achievements of 1901, which were heralded from one continent to the other as the most remarkable tests ever made on either side of the Atlantic, certainly constitute one of the greatest events in the history of the automobile, for they produced a new series of world's records: that of Fournier, who sped over the mile in his 40 horse-power Mors racer in the remarkable time of 51 4-5 seconds, and that of A. L. Riker, who lowered Winton's record mile for electric carriages by covering the course in one minute and three seconds.

These records, wonderful as they seemed, represented but the beginning of fast automobiling, for on 12 Nov. 1902 M. Augieres offset Fournier's achievement by establishing a record of 46 seconds, while G. A. Cannon of Providence, R. I., established the steam carriage record at 1:01, during the same year. In 1904, all the world's records were changed at the Ormond-Daytona course in Florida, W. K. Vanderbilt, Jr., covering a mile in his gasoline racer in just 39 seconds; Louis S. Ross placing the steam record at 55 3-5 seconds, and W. J. Hastings the electric record by making his mile in 1:00 3-5. On 30 May 1910, at the Daytona course, 3-5. On 30 May 1910, at the Daytona course, Oldfield made a mile in 27m, 33 seconds, using a Benz car. Of course, at the present time there is no power except that of the locomotive engine that is capable of attaining such a rate of speed as that which is made by the automobile, and, in 1910, the mile record for railway travel was still held at 32 seconds, the achievement of the New York Central's Empire State Express. In the establishment of the locomotive record, however, the single mile spurt counts for but little. In many respects a locomotive is like a man. For example, it must have a certain combination of physical qualities before it can sprint fast, but

Digitized by Google

when to the sprinting qualities is added that of the ability to maintain this speed, one finds that it is really the capacity to develop power and to transport it properly to the various members of the machine that counts. H. G. Prout, editor of the 'Railway Gazette,' in his study of 'The Fastest Trains,' admits that it is not improbable that engines may several times have been driven at a rate equal to or in excess of 100 miles an hour, but there is no authentic record to exceed that of the Philadelphia & Reading train which in July 1904 covered a distance of 4.8 miles at the rate of 115.20 miles per hour.

The first published record of a train having attained a speed of anything like 90 miles an hour was in 1884 when it was reported that one of the Baltimore & Ohio trains had maintained this speed for six consecutive miles. As the report was not accompanied by authentic evidence the record was questioned and has never been established. In 1890 a much faster run was made on the Philadelphia & Reading when a distance of 4.1 miles was covered at an average speed of 98.4 miles an hour. Two years later one of the Central of New Jersey engines drew four cars for a mile at a speed of 97.3, but in 1893 the New York Central Railway offset all these performances by producing a record of five miles run at the rate of 100 miles an hour, and of one mile at the still greater speed of 102.8 miles per hour. It was in May of this year that the New York Central officials began to talk of the 112-mile locomotive and they exhibited one at the World's Fair which they claimed had made this record, a fact which, although not fully verified, is generally accepted. In 1895 a five car train was run on the Pennsylvania Railway for a distance of five miles at a speed in excess of 102 miles an hour, while in September 1897 an engine attached to four cars on the Pittsburg, Cincinnati, Chicago and Saint Louis system made a run of one mile at a speed of somewhere between 100 and 104 miles an hour, and in October of the same year two cars were run on the Baltimore and Washington branch of the Pennsylvania Railway for a distance of more than 15 miles at a speed of 100.7 miles an hour. Included in that run there was a distance of 6.9 miles which was made at a rate of 103.5 miles an hour, an achievement which was not equaled until June 1899, when an engine drew four cars over the same distance at an equally rapid speed. On 18 Feb. 1901 an engine on the Savannah, Florida and Western made a run of a trifle more than four miles in Georgia at a rate of a little more than 107 miles an hour. Since then the Michigan Central established a record of 111.90 miles per hour (April 1904), the New York Central 109.35 miles (January 1903) and the Burlington Route 108 miles (1899).

No better idea of the improvement in railway speed may be obtained that from the following comparative illustration. In 1862 an ammunition train was to be taken from Baltimore to Hagerstown. As the ammunition was much needed by Gen. McClellan, who was at Antietam, the train of five cars was driven over the 158 miles at an average speed of 37 miles an hour, and yet this speed, slow as it may appear to-day, was so unusual that the train reached Hagerstown with the journal boxes on four of the cars ablaze.

Although it would be a simple matter to trace the history of the improvement in the ocean schedules back to 1819, when the old Savannah paddled herself from America to Cork in 26 days, the actual work of breaking the record did not begin until the Acadia of the Cunard line, in 1841, cut the average steamship time of 14 days to below 10. Since that time the record has been constantly lowered, until we reach the remarkable 4-day's record of the Lusitania and the Mauretania.

The records for covering of the distance from New York to Queenstown follow:

1852, Baltic, 9d, 13h, 42m; 1856, Persia, 9d, 1h, 45m; 1863, Scotia, 8d, 2h, 48m; 1897, City of Paris, 8d, 4h, 1m; 1867, Russia, 8d, 28m; 1869, City of Brussels, 7d, 22h, 3m; 1873, Baltic, 7d, 20h, 9m; 1875, City of Berlin, 7d, 15h. 28m; 1876, Germanic, 7d, 15h, 17m; 1876, Britannic, 7d, 12h, 47m; 1877, Germanic, 7d, 11h, 37m; 1877, Britannic, 7d, 10h, 52m; 1879, Arizonia, 7d, 8h, 11m; 1882, Alaska, 6d, 12h, 37m; America, 6d, 14h, 18m; 1884, Oregon, 6d, 9h, 42m; 1885, Etruria, 6d, 5h, 31m; 1887, Umbria, 6d, 4h, 42m; 1888, Etruria, 6d, 1h, 55m; 1889, Paris, 5d, 19h, 18m; 1891, Majestic, 5d, 18h, 8m; 1891, Teutonic, 5d, 16h, 31m; 1892, City of Paris, 5d, 14h, 21m; 1893, Campania, 5d, 12h, 7m; 1894, Lucania, 5d, 7h, 23m; 1908, Lusitania, 4d, 15h; 1910, Mauretania, 4d, 10h, 14m.

In 1900 Kaiser Wilhelm der Grosse established a record of 5d, 16h, New York to Cherbourg, which was lowered over the same route, but coming west, by the Kronprinzessin Cecilie in 1908 with the time of 5d, 11h, 9m.

Speedy as the steam engine may be, however, the sporting instincts of man have never been greatly aroused over this form of record breaking. In fact, so far as human interest is concerned there is no form of speed reduction that has appealed so strongly to man as that in which the horses have been engaged. The runner, for example, has always been the idol of the human race and for untold centuries thousands have gathered to watch the gallant struggles of these animals straining for victory. To-day, however, the running horse is not the only thoroughbred, for the trotter, descendant of the great Hambletonian, has proved such a formidable rival that thousands of people are now more interested in the record-making capabilities of the harness horse.

For more than 20 centuries the runner has been striving for the reduction of speed and, in 1877, when Ten Broeck made the mile in 1:39¾ it seemed that the end had been reached. In fact it was not until 1890, when the great Salvator reduced the record to 1:35½ on the straightaway track at Monmouth Park, N. J., that a faster horse was found, and this stands as the fastest record-mile, the nearest approach to it being Kildeer's 1:37½, which was made in a race in 1892, whereas Salvator's record was against time. And as both of these are straighaway records they are somewhat lower than the achievements on the circular track, which have reduced the record mile from Voter's 1:38 in 1900 to the 1:37⅘ of Dick Welles in 1903 and Fern L. in 1908.

The following table which shows the win-

Digitized by Google

STAKE WINNERS OF THE PAST — 1888–1910

Year	Event	Winner	Distance	No. of starters	Time	Value of stake
1888	Suburban	Elkwood	1¼ m.	9	2:07¼	6,812
"	Brooklyn Handicap	The Bard	1¼ m.	11	2:13	6,925
"	Futurity	Proctor Knott	6 fur.*	14	1:15¼	40,900
1889	Suburban	Raceland	1¼ m.	9	2:09 4/5	6,900
"	Brooklyn Handicap	Exile	1¼ m.	7	2:07¾	6,900
"	Futurity	Chaos	6 fur.*	23	1:16 4/5	54,550
1890	Suburban	Salvator	1¼ m.	9	2:06 4/5	6,900
"	Brooklyn Handicap	Castaway II	1¼ m.	9	2:10	14,800
"	Futurity	Potomac	6 fur.*	15	1:14 1/5	67,675
1891	Suburban	Loantaka	1¼ m.	10	2:07	9,900
"	Brooklyn Handicap	Tenny	1¼ m.	21	2:10	14,800
"	Futurity	His Highness	6 fur.*	21	1:15 1/5	61,675
1892	Suburban	Montana	1¼ m.	11	2:07 2/5	17,750
"	Brooklyn Handicap	Judge Morrow	1¼ m.	12	2:08¾	17,750
"	Futurity	Morello	6 fur.*	17	1:12 1/5	40,450
1893	Suburban	Lowlander	1¼ m.	9	2:06 3/5	17,750
"	Brooklyn Handicap	Diablo	1¼ m.	13	2:09	17,500
"	Futurity	Domino	6 fur.*	20	1:12 4/5	49,350
1894	Suburban	Ramapo	1¼ m.	12	2:06 1/5	12,070
"	Brooklyn Handicap	Dr. Rice	1¼ m.	14	2:07¼	17,750
"	Futurity	Butterflies	6 fur.*	17	1:11	48,710
1895	Suburban	Lazzarone	1¼ m.	6	2:07 4/5	4,730
"	Brooklyn Handicap	Hornpipe	1¼ m.	12	2:11¼	7,750
"	Futurity	Requital	6 fur.*	20	1:11 2/5	53,190
1896	Suburban	Henry of Navarre	1¼ m.	7	2:07	5,850
"	Brooklyn Handicap	Sir Walter	1¼ m.	8	2:08½	7,750
"	Futurity	Ogden	6 fur.*	10	1:10	43,790
1897	Suburban	Ben Brush	1¼ m.	9	2:07 1/5	5,850
"	Brooklyn Handicap	Howard Mann	1¼ m.	11	2:09¾	7,750
"	Futurity	L'Alouette	6 fur.*	18	1:11	34,290
1898	Suburban	Tillo	1¼ m.	11	2:08 1/5	6,800
"	Brooklyn Handicap	Ornament	1¼ m.	8	2:10	7,800
"	Futurity	Martinmas	6 fur.*	23	1:12 2/5	36,310
1899	Suburban	Imp	1¼ m.	13	2:08 2/5	6,800
"	Brooklyn Handicap	Banastar	1¼ m.	16	2:06 1/5	7,800
"	Futurity	Charcornac	6 fur.*	20	1:10 2/5	30,630
1900	Suburban	Kinley Mac	1¼ m.	10	2:06 4/5	6,800
"	Brooklyn Handicap	Kinley Mac	1¼ m.	9	2:10	7,800
"	Futurity	Ballyhoo Bey	6 fur.*	12	1:10	33,580
1901	Suburban	Alcedo	1¼ m.	11	2:09 3/5	7,800
"	Brooklyn Handicap	Conroy	1¼ m.	9	2:09	7,800
"	Futurity	Yankee	6 fur.*	19	1:09 1/5	36,850
1902	Suburban	Gold Heels	1¼ m.	11	2:05 1/5	7,800
"	American Derby	Wyeth	1½ m.	12	2:40 1/5	19,875
"	Brooklyn Handicap	Reina	1¼ m.	14	2:07	7,800
"	Futurity	Savable	6 fur.*	24	1:14	44,550
1903	Suburban	Africander	1¼ m.	15	2:10 2/5	16,490
"	" (Renewal)	Waterboy	1¼ m.	7	2:04 3/5	9,900
"	American Derby	The Picket	1½ m.	19	2:33	27,025
"	Brooklyn Handicap	Irish Lad	1¼ m.	12	2:05 2/5	14,950
"	Futurity	Hamburg Belle	6 fur.*	18	1:13	35,940
1904	Suburban	Hermis	1¼ m.	6	2:05	16,800
"	American Derby	Highball	1½ m.	9	2:33	26,325
"	Brooklyn Handicap	The Picket	1¼ m.	16	2:06 3/5	15,800
"	Futurity	Artful	6 fur.	16	1:11 4/5	42,880
1905	Suburban	Beldame	1¼ m.	....	2:05 3/5	16,800
"	Brooklyn Handicap	Delhi	1¼ m.	....	2:06 2/5	15,800
"	Futurity	Ormondale	6 fur.	....	1:11 4/5	38,680
1906	Suburban	Go Between	1¼ m.	12	2:05 1/5	16,800
"	Brooklyn Handicap	Tokalon	1¼ m.	14	2:05 3/5	15,800
"	Futurity	Electioneer	6 fur.	15	1:13 3/5	37,270
1907	Suburban	Nealon	1¼ m.	....	2:06 2/5	16,800
"	Brooklyn Handicap	Superman	1¼ m.	....	2:09	15,800
"	Futurity	Colin	6 fur.	....	1:11 1/5	24,830
1908	Suburban	Ballot	1¼ m.	....	2:03	19,750
"	Brooklyn Handicap	Celt	1¼ m.	....	2:04 1/5	19,750
"	Futurity	Maskette	6 fur.	....	1:11 1/5	24,985
1909	Suburban	Fitz Herbert	1¼ m.	....	2:03 2/5	3,850
"	Brooklyn Handicap	King James	1¼ m.	....	2:04	3,850
"	Futurity	Sweep	6 fur.	....	1:11 4/5	25,710
1910	Suburban	Olambala	1¼ m.	....	2:04 2/5	6,000
"	Brooklyn Handicap	Fitz Herbert	1¼ m.	....	2:05 3/5	6,000
"	Futurity	Novelty	6 fur.	....	1:12 1/5	10,000

* Since 1902 the Futurity course has been full six furlongs. From 1892 to 1901 it was 1,263 yds. 1 ft.

ners of the most important American stake events constitutes a somewhat comprehensive history of the work of the running horses since 1888.

While the runner has been ages lowering his record to 1:35½, the trotter has been little more than half a century in reducing his time from 2:30 to 1:58½, a record which has been still further reduced by the pacer to 1:55. In fact it has been within the memory of living man when a three-minute trotter was pretty sure to be the equal if not the superior to anything on the road. Then came the period when the "2:40 tail over the dashboard" was expressive of the limit of the trotter's speed, and these conditions continued until about 1856, when Flora Temple stepped out of the 2:30 class and established a record the descent from which has been almost by seconds, or fractions of seconds, down to 1906, when the 1:57 of Prince Alert and the 1:55 of Dan Patch made entirely new records for both trotting and pacing. (See HORSE-RACING.)

The subjoined table, which exhibits the record mile for all kinds of locomotion, is corrected to 1910.

In mechanism, next to the automobile, the speed of which depends as much upon the perfection of the mechanism as upon the alertness of the brain behind it, man's fastest time has been made upon the bicycle, and now that the success of the motor cycle has been established he has another rival with which to contest with the more mechanical automobile. Although the bicycle has been in use for nearly thirty years, the first conspicuous record making did not occur until 1880, when Ralph Ahl rode a mile on an "ordinary" at Boston in 2:59½. This achievement was accomplished indoors, but when, from one end of the country to the other, a protest went up from people who denied that he could accomplish such a feat, Ahl repeated his attempt out of doors and succeeded in making a mile in the same time. This record has been steadily reduced, however, until it now stands at 1:52, the time made in 1910 by A. J. Clarke at Salt Lake City, on a circular track without pace; at 1:05, for a 5-lap track with motor pace, the time made by Ray Duer, and at 57 4-5 seconds, the record "Charlie" Murphy made in 1899, when he rode behind a wind shield attached to the rear of a railway train.

Although walking and sprinting were once

THE MILE RECORD, 1910—ALL KINDS OF LOCOMOTION.

Locomotion		Record			Track		Conditions of Contest
Method	Means	Time M. S.	Holder	Date	Course	Location	
Automobile......	Electric.	1:00 3/5	W. J. Hastings.	Feb. 1, 1904	Straight.	Ormond-Daytona, Fla.	Against time.
"	Gasoline.	0:27⅓	Oldfield.	Mar. 16, 1910	"	"	" "
"	Steam.	0:28 1/5	Marriott.	Jan. 25, 1906	"	"	" "
Bicycle.........	Man.	0:57 4/5	C. M. Murphy.	Jan. 30, 1899	"	Long Island, N. Y.	Following locomotive with wind.
"	"	1:05	Ray Duer.	June 27, 1909	5-lap.	Los Angeles, Cal.	Paced by motor.
"	"	1:52	A. J. Clarke.	Aug. 2, 1910	Circular.	Salt Lake City, Utah.	Unpaced.
" (tandem) .	2 men.	1:37 3/5	McCarthy and Munroe.	Oct. 3, 1899	"	Brockton, Mass.	Paced by motor.
" (triplet)..	3 "	1:40 2/5	Fornwalt, Munroe, and Johnson.	July 30, 1898	"	Philadelphia.	" " "
" (quad)....	4 "	1:40	Schineer, Newkirk, Bohman and Brodie.	Aug. 20, 1898	"	Chicago, Ill.	" " "
" (quint)...	5 "	1:46 2/5	Callahan, Butler, Pierce, Walsh, and Coleman.	Aug. 1, 1898	"	Cambridge, Mass.	" " "
" (sext.)....	6 "	1:41 1/5	Saunders, Pierce, Butler, Caldwell, Crooks, and Coleman.	Sept. 26, 1896	"	"	" " "
"	Motor.	0:42 3/5	Fred Huyck.	July 31, 1909	5-lap.	Springfield, Mass.	Against time.
" (tandem).	"	1:18 1/5	Henshaw and Hedstrom.	Aug. 13, 1901	Circular.	Buffalo, N. Y.	In competition.
Canoeing.......	Man.	9:29	A. F. Mackendrick.	Aug. 20, 1890	Water.	Jessup's Neck, L. I.	" "
Pacing..........	Horse.	1:55	Dan Patch.	Sept. 8, 1906	Circular.	St. Paul, Minn.	Against time with pace and wind shield.
" (team)....	2 horses.	2:02¾	Lady Maud C. and Hedgewood Boy.	Aug. 13, 1909	"	Grand Rapids, Mich.	Against time.
Pigeons.........	Flying.	0:40	Bird owned by W. J. Lautz.	1900	Air.	Buffalo, N. Y.	Computed time.
Railroad........	Steam.	132	Empire State Express.	May 10, 1893	Rail.	....	Favorable.
Rowing (sculling)	Man.	4:28	James Stansbury.	July 11, 1896	Water.	London, England.	Heavy tide behind.
"	4 men.	4:23	Hillsdale crew.	1893	"	"	Favorable.
"	8 "	4:06	University crew.	1893	"	"	"
Running........	Man.	4:12¾	W. G. George.	Aug. 23, 1886	Circular.	"	Professional.
"	"	4:15 2/5	T. Cunniff.	1895	"	Travers Island.	Amateur.
" (relay)..	4 men.	3:21 2/5	Wefers, Long, Burke, and Lyons.	Aug. 28, 1896	"	New York City.	Each ¼ mile.
"	Horse.	1:35½	Salvator.	Aug. 28, 1900	Straight.	Monmouth Park, N. J.	Against time.
Sailing..........	Wind.	4:19½	Sch. Constellation.	July 30, 1895	Water.	Long Island Sound.	Computed time.
Skating.........	Man.	2:12⅗	Tom Donoghue.	Feb. 1, 1897	Straight.	Newburgh, N. Y.	Strong wind behind.
"	"	2:35 3/5	J. S. Johnson.	Feb. 4, 1899	Circular.	Montreal, Can.	Against time.
Steamship.......	Steam.	1:55 2/5	Deutschland.	Aug., 1900	Water.	London to New York.	Computed time.
Swimming.......	Man.	23:16 4/5	B. Keran.	....	"	Australia.	Professional.
Trotting........	Horse.	1:58½	Lou Dillon.	Oct. 24, 1903	Circular.	Memphis, Tenn.	Against time, with pace and wind shield.
" (team)...	2 horses.	2:07¾	The Monk and Equity.	Oct. 21, 1904	"	" "	Against time.
Walking........	Man.	6:23	W. Perkins.	June 1, 1894	"	London, England.	Professional.
"	"	6:29 1/5	G. H. Goulding.	Feb. 26, 1910	"	Buffalo, N. Y.	Amateur.

Digitized by Google

chiefly professional sports, the interest that has been taken in them during the past few years has centred largely upon the amateur class of athletes who have attempted to establish records in these directions. So far as running is concerned there are few authentic records that antedate 1878, when "Paddy" McDonald placed the mile record at 4:42. Previous to this time the best time had been somewhere in the fifties.

McDonald's record stood for about two years, but, in the early eighties, "Lon" Myers cut the time to 4:29½, and, afterward, to 4:27. In 1883, W. G. George, who came to this country from England, established a new world's record at 4:21 3-5, and this stood until 1891, when "Tommy" Conneff, on the Manhattan Field, clipped one fifth of a second from it. Important as this was, however, it was but the beginning of Conneff's work, for, during the same year, when sprinting at Travers Island, he reduced the record to 4:17 4-5, an achievement which was still further surpassed in 1895, when he once more succeeded in lowering his own and the world's amateur record by running a mile in 4:15⅗, a feat which has never been equaled in amateur circles, although George afterwards established a professional record of 4:12¾.

The early walking records, like those of the runners, are extremely obscure until 1870. Then "Dan" Stern, of the New York Athletic Club, achieved the distinction of being the first man to walk a mile in seven minutes. This feat was slightly improved upon by Edward Halske, a year or two later, but no great reduction was made until 1877, when Harry Armstrong cut the record to 6:40, a figure at which it stood until 1883, when Frank P. ("Cinders") Murray placed it at 6:29 3-5. In 1910, G. H. Goulding lowered it to 6:29⅕, Perkins' professional record being but a trifle lower, 6:23.

The following tables show the manner in which the records of the harness horses have been reduced:

REDUCTION OF THE TROTTING RECORD — 1818–1904.

Date	Horse	Time
1818	Boston Blue	3:00
1824*	Albany Pony	2:40
1834*	Edwin Forrest	2:31½
1835	Oneida Chief	2:31
1839*	Dutchman	2:28
1845	James K. Polk	2:27
1849*	Lady Suffolk	2:26
1853	Highland Maid	2:27
1853*	Tacony	2:25½
1856	Flora Temple	2:24½
1859	" "	2:19¾
1865	Dexter	2:18¼
1866	"	2:18
1867	"	2:17¼
1871	Goldsmith Maid	2:17
1872	" "	2:16¾
1874	" "	2:14
1878	Rarus	2:13¼
1879	St. Julien	2:12¾
1880	Maud S.	2:10¾
1881	" "	2:10¼
1884	" "	2:09¾
1885	" "	2:08¾
1891	Sunol	2:08¼
1892	Nancy Hanks	2:04
1894	Alix	2:03¾
1900	The Abbot	2:03¼
1901	Cresceus	2:02¼
1903	Lou Dillon	1:58½

* Made to saddle.

REDUCTION OF THE PACING RECORD — 1839–1904.

Date	Horse	Time
1839	Driver	2:28
1844	Fanny Ellsler	2:27½
1844	Unknown	2:23
1851	Pet	2:21
1852	"	2:19¼
1852	"	2:18½
1855	Pocahontas	2:17¼
1869	Billy Corbeau	2:16¼
1878	Sweitzer	2:15½
1879	Sleepy George	2:15
1879	Sleepy Tom	2:14½
1879	" "	2:14¼
1881	Little Brown Jug	2:11½
1883	Johnston	2:10
1884	"	2:06¼
1891	Direct	2:06
1892	Hal Pointer	2:05¼
1892	Mascot	2:04¼
1893	Flying Jib	2:04
1894	Robert J.	2:03¾
1894	" "	2:03⅓
1894	" "	2:01½
1896	John R. Gentry	2:01½
1896	" " "	2:00½
1897	Star Pointer	1:59¼
1902	Dan Patch	1:59¼
1903	" "	1:56¼
1906	" "	1:55

GEORGE M. SANDS,
New York '*Globe and Commercial.*'

Speed'well, The, a sister ship of the Mayflower, which sailed for Plymouth, but was unseaworthy, and put back to port. See MAYFLOWER, THE.

Speedwell, a genus (*Veronica*) of annual and perennial herbs and shrubs of the order *Scrophulariaceæ*. The 200 species are mostly natives of the north temperate zone; some, mostly shrubby, are tropical or subtropical, and others are Australian. They are found in all kinds of soils, and many are cultivated in gardens for their beautiful white, blue, or pink flowers arranged in axillary or terminal racemes. The taller-growing kinds are used mainly as border plants, the dwarfed in rock-gardens; the shrubby kinds are everblooming in California. Some of the species were formerly reputed medicinal; and some of these were used as substitutes for tea.

Speer, spēr, **Emory,** American jurist: b. Culloden, Georgia, 3 Sept. 1848. He served in the Confederate army during the last two years of the Civil War; was graduated from the University of Georgia in 1869; studied law, and became solicitor-general of Georgia. He was a member of Congress from Georgia as an independent Democrat, 1879–81 and as Independent 1881–83; he was United States attorney 1883–5; and has been United States Judge of the Southern district of Georgia since 1885. He is also president of the law department of Mercer University, and is an orator of prominence. He is the author of a legal work on 'Removal of Causes from State to United States Courts' (1888), and of 'Lectures on the Constitution of the United States.'

Speke, spēk, **John Hanning,** African explorer; b. near Ilchester, Somerset, 4 May 1827; d. near Bath 15 Sept. 1864. In 1844 he entered the army and took part in the Sikh war. During his leave of absence he made hunting and exploring expeditions over the Himalayas and through parts of Tibet, collecting many specimens of animals, plants, and minerals. In 1854 he accompanied Burton's party in their expedition to

Digitized by Google

Somali Land. He next served in the Crimean war, and at its close was invited by Burton to join him in an African expediton, to be carried out at the expense of the home and Indian governments. In June, 1858, Speke and Burton proceeded inland from the east coast, their object being to ascertain the position of the great lakes of the interior, confused accounts of which had been from time to time received from the natives. The great lake Tanganyika was discovered, and Burton falling sick, Speke proceeded north and discovered the south end of the Victoria Nyanza, which he correctly judged to give birth to the Nile. In 1860 he led another expedition, organized by the Royal Geographical Society, which explored the western and northern margin of the Victoria lake, and found a river flowing out of the lake, which turned out to be the White Nile. After long delays in Uganda and Unyoro the travelers proceeded northward, and at Gondokoro met Sir Samuel Baker, who was leading an expedition southward. Returning home he was killed by the accidental discharge of his gun while out shooting. He published 'Journal of the Discovery of the Source of the Nile' (1863); and 'What Led to the Discovery of the Source of the Nile' (1864.)

Speke's Antelope. See BUSHBUCK.

Spelling, the manner in which words are formed with letters. It was originally phonetic, each symbol or character representing a distinct vocal sound, and that is the aim of every phonetic alphabet (see PHONETICS), as well as of every alphabet constructed for the purpose of representing unequivocally the sounds either of one or of several languages; a universal alphabet constructed on phonetic principles would comprise separate symbols for the sounds heard in all languages. The Spanish alphabet is practically phonetic, the German alphabet, the Italian alphabet, are hardly inferior to the Spanish in this respect. The English alphabet departs most widely from phonetism. In English spelling there is no consistency; in English one vowel-symbol may represent three, four, five or more distinct sounds, and the same sound may be represented by several vowel characters. So too with consonants, as seen in *get, gin; cell, call; arch, archaic.* Both vowels and consonants are often superfluous, as the final consonants in *climb, contemn,* the vowel *a* in *season, reason,* the final *e* in *done, lone;* and so on. English spelling is unscientific and anomalous to the last degree; yet the slightest departure from the received orthography is by common consent held to be conclusive evidence of ineducation; and public opinion both in America and England frowns upon even the most «conservative» schemes of spelling reform.

Spelling Reform, a proposed change of the present English orthography. In 1884 the American Spelling Reform Association formulated the following rules of spelling, and they have been endorsed by the Spelling Reform Association of England:

1. e.— Drop silent *e* when fonetically useless, as in *live, vineyard, believe, bronze, single, engine, granite, eaten, rained,* etc.
2. ea.— Drop *a* from *ea* having the sound of *e*, as in *feather, leather, jealous,* etc.
   Drop *e* from *ea* having the sound of *a*, as in *heart, hearken,* etc.
3. eau.— For *beauty* use the old *beuty.*
4. eo.— Drop *o* from *eo* having the sound of *e*, as in *jeopardy, leopard.*
   For *yeoman* write *yoman.*
5. i.—Drop *i* from *parliament.*
6. o.— For *o* having the sound of *u* in *but,* write *u*, in *above,* (abuv), *dozen, some* (sum), *tongue,* (tung), etc.
   For *women* restore *wimen.*
7. ou.— Drop *o* from *ou* having the sound of *u*, as in *journal, nourish, trouble, rough* (ruf), *tough* (tuf), and the like.
8. u.— Drop silent *u* after *g* before *a*, and in native English words, as *guarantee, guard, guess, guest, guild, guilt,* etc.
9. ue.— Drop final *ue* in *apologue, catalogue,* etc., *demagogue, pedagogue,* etc., *league, colleague, harangue, tongue,* (tung), etc.
10. y.— Spell *rhyme* rime.
11. Dubl consonants may be simplified.
    Final *b, d, g, n, r, t, f, l, s,* as in *ebb, add, egg, inn, purr, butt, bailiff, dull, buzz,* etc. (not *all, hall*).
    Medial before another consonant, as *battle, ripple, written* (writn), etc.
    Initial unaccented prefixes, and other unaccented syllables, as in *abbreviate, accuse, affair,* etc., *curvetting, traveller,* etc.
12. b.—Drop silent *b* in *bomb, crumb, debt, doubt, dumb, lamb, limb, numb, plumb, subtle, succumb, thumb.*
13. c.— Change *c* back to *s* in *cinder, expence, fierce, hence, once, peace, scarce, since, source, thence, tierce, whence.*
14. ch.— Drop the *h* of *ch* in *chamomile, choler, cholera, melancholy, school, stomach.*
    Change to *k* in *ache* (ake), *anchor* (anker).
15. d.— Change *d* and *ed* final to *t* when so pronounced, as in *crossed* (crost), *looked* (lookt), etc., unless the *e* affects the preceding sound, as in *chafed, chanced.*
16. g.—Drop *g* in *feign, foreign, sovereign.*
17. gh.— Drop *h* in *aghast, burgh, ghost.*
    Drop *gh* in *haughty, though* (tho), *through* (thru).
    Change *gh* to *f* where it has that sound, as in *cough, enough, laughter, tough,* etc.
18. l.— Drop *l* in *could.*
19. p.— Drop *p* in *receipt.*
20. s.— Drop *s* in *aisle, demesne, island.*
    Change *s* to *z* in distinctive words, as in *abuse* verb, *house* verb, *rise* verb, etc.
21. sc.— Drop *c* in *scent, scythe* (sithe).
22. tch.— Drop *t* in *catch, pitch, witch,* etc.
23. w.— Drop *w* in *whole.*
24. ph.— Write *f* for *ph*, as in *philosophy, sphere,* etc.

Spel'man, SIR Henry, English antiquary: b. Cougham, Norfolk. 1562; d. London 1641. He was graduated at Trinity College, Cambridge, 1583, and then attended Lincoln's Inn. He was a member of Parliament in 1597, high sheriff of Norfolk in 1604, and performed several public services for King James I. He was knighted in 1612 and retired to lifelong study, founding, in 1635, a short-lived Anglo-Saxon readership at Cambridge. His writings include 'De non Temerandis Ecclesiis' (1613); his colossal work, 'Glossarium Archæologicum,' of which he published volumes A to L (1626), the remainder being brought out by his son; and the material for his 'History of Sacrilege,' and his works on 'The Councils of the Church' and 'The Tenures of Knight Service' all of which were left incomplete and were posthumously issued.

Spel'ter, in commerce, a name frequently applied to zinc, and to an impure zinc of a yellowish color used in soldering brass joints. Bell metal composition is also called spelter.

Spence, spĕns, **Henry Donald Maurice,** English Anglican clergyman and author; b. London 14 Jan. 1836. He was educated at Cambridge, took orders in the Established Church, and was professor of English literature at St. David's College, Lampeter, Wales, 1865-70, and rector of Saint Mary de Crypt, Gloucester, 1870-7. He was principal of Gloucester Theological Col-

Digitized by Google

lege 1875–7, vicar of St. Pancras, London, 1870–86, and dean of Gloucester from the last named date. Among his many published books are: 'Dreamland and History'; 'The Church of England: a History for the People'; 'The White Robe of the Churches of the 11th Century'; 'Christianity.'

Spencer, spĕn'sėr, **Ambrose,** American jurist: b. Salisbury, Conn., 13 Dec. 1765; d. Lyons, N. Y., 13 March 1848. He was educated at Yale and Harvard universities and was graduated from the latter in 1783. He was admitted to the bar in Hudson, N. Y., where he was elected city clerk in 1786. In 1793 he represented Columbia County in the State legislature; in 1795 and for 7 consecutive years was state senator; in 1804 became a justice of the Supreme Court, and in 1819 was promoted to be chief justice, which office he resigned in 1823, and resumed the practice of his profession at Albany. He was for some years mayor of that city, and also represented the Albany district in Congress. In 1844 he presided over the National Whig convention at Baltimore. His energy, resolution, and high legal attainments left a permanent impress on the constitution and institutions of New York.

Spencer, George John, Earl, English politician and bibliophile: b. Wimbledon, Surrey, 1 Sept. 1758; d. Althorp 10 Nov. 1834. He was educated at Harrow and Cambridge, and was elected member of Parliament for the county of Northampton. In 1783 he became Earl Spencer. In the House of Lords he voted with the Whigs till the period of the French Revolution, when, with some others of the party, he joined the party of Pitt. In 1794–1801 he was first lord of the admiralty and in 1806–7 was secretary of state for the home department. Earl Spencer was president of the Roxburghe Club at its origination, and possessed the largest and richest private library in the world. The foundation of his library was laid in 1789, by the purchase of books in all parts of Europe. It was described by Dibden in 'Bibliotheca Spenceriana' (1814). The bulk of this library is now included in the Rylands Library, Manchester.

Spencer, Herbert, philosopher and exponent of the modern philosophy of evolution, was b. Derby, England, 27 April 1820; d. 8 Dec. 1903. His father was a teacher, a nonconformist, who was for years a Wesleyan, but who afterward seceded from that religious body and remained to the end of his life somewhat indifferent to outward religious forms, although a deeply religious man. The subsequent tendency of Spencer's philosophy was indirectly, but in a very potent way, determined by the education that his father gave him during his childhood and early youth. It was an education that decidedly tended to quicken his interest in the study of nature, and to develop his powers of independent thought, and of inquiry into the nature of things. Furthermore, the nonconformist atmosphere in which Spencer grew up strongly tended to cultivate in his mind political liberalism of the type then characteristic of many of the most progressive English minds. In 1837 Spencer began the study of engineering under Mr. Charles Fox, the engineer of the London & Birmingham Railway, then recently constructed. Spencer continued his work in the service of the railway, with some interruptions, until 1841. In 1843 he went to London and engaged in contributing to the various periodicals, and in somewhat varied activities of a miscellaneous sort, until 1850. In 1842 he wrote a series of letters to 'The Nonconformist'—a newspaper then recently established as an organ of the Dissenters. The letters dealt with some principles relating to the influence of legislation upon social processes, and began the train of thought which Spencer later developed in his 'Social Statics.' The 'Social Statics,' his first book, was written between 1848 and 1850, and is characterized by the author himself as "a kind of natural history-ethics." The work especially maintains the doctrine of the right of the individual, and of the necessity for noninterference on the part of the government. The characteristic of Spencer's sociological studies at this time, as contrasted with those of other English liberals who were his contemporaries, was the tendency to base the doctrine of non-interference upon very general considerations derived from natural history and from the study of natural law in general. Society, like the individual organism, is, so Spencer now teaches, the result of a growth, which is subject to determinate natural conditions, which in consequence tends on the whole to results advantageous, in the end, to individuals, while this growth of society cannot be safely interfered with by artificial devices. A generalization of the interests which Spencer thus early expressed led him within the next few years to a study of the processes of growth in nature in their more general aspects. Accepting, almost as soon as he distinctly conceived of it at all, the doctrine that all living forms are the result of natural processes of growth, and are not due to special creation, Spencer was led during the immediate following years to an effort to formulate in general terms the "law of progress," or of development, which he conceived to be common to all such processes of growth. In 1854–5 he wrote the first edition of his 'Principles of Psychology,' in which he endeavored, first, to characterize in a decidedly novel way the nature and processes of life in general, and then to apply this general formula to the investigation of the development of mind. Life, Spencer now defines, as a series of changes occurring in an organism in such ways as involve "a continuous adjustment of inner relations to outer relations." The mental processes are then defined as a special accompaniment and result of the adjustment in question. Between 1856 and 1860 Spencer, despite considerable interruption through ill health, published a large number of essays in various periodicals, among which the most important are: (1) the four papers which were later brought together in his volume on 'Education,' and (2) a number of essays tending toward the final expression of his general formula for evolution. As both bodily and mental development had now come, in Spencer's mind, to be conceived as subject to universal and common laws, he began to consider the possibility of a system of philosophy in which the general process of evolution should be stated in terms applicable to all kinds of development. The first sketch of this system of philosophy was outlined in 1858; and in 1860 the definitive programme of the 'System of Synthetic Philosophy' was written

Digitized by Google

Herbert Spencer

Digitized by Google

out. The first edition of the 'First Principles,' which constituted the first part of this "system," was prepared between 1860 and 1862, and was issued to subscribers in parts. The second part of the 'System of Synthetic Philosophy,' namely, the 'Principles of Biology,' was issued between 1862 and 1867. In 1867 Spencer recast and reissued his 'First Principles.' Between 1867 and 1870 he developed a new statement of his 'Principles of Psychology' as modified by the further development of his doctrine. The 'Psychology' in its new form was finished by 1872, and formed the third part of the system. The plan of Spencer's system required, next in order, the application of his principles to the study of sociology, an undertaking which proved to require a longer time than Spencer had originally contemplated. In 1872-3, at the instance of Spencer's American friend, Prof. E. L. Youmans, Spencer prepared, as an "extra book"—not a part of the system—a volume for the International Scientific Series, entitled 'The Study of Sociology.' In 1874 the first volume of the 'Principles of Sociology' began to be issued. For this work Spencer had been making, since 1867, and with the aid of secretaries, the elaborate collections of material which were, in a series of years, published under the title 'Descriptive Sociology.' After completing the first volume of the 'Principles of Sociology,' Spencer turned for the time to the beginning of what was to be the last division of his system, namely, ethics, and published, in 1879, the 'Data of Ethics.' The succeeding years, until the completion of Spencer's system in 1900, were principally devoted to the preparation of the second and third volumes of the 'Principles of Sociology,' and to the completion of the 'Ethics.' The 'Descriptive Sociology' continued to be issued until 1881 in parts. From time to time throughout the period of the preparation of the synthetic philosophy Spencer was interrupted for greater or shorter intervals by ill health. But he never theless found time to prepare and to publish a considerable number of essays of a controversial character, relating to his system and to its critics; to contribute also to various topics of current discussion; and his 'Autobiography,' published in 1904, is still another of the evidences of his extraordinary productiveness.

The complete list of Spencer's works, published during his lifetime, in the form which they finally assumed, in so far as he regarded them as worthy of permanent place among his productions, is as follows: First, the 'Synthetic Philosophy' itself, consisting of 'First Principles,' one volume; 'The Principles of Biology,' two volumes; 'The Principles of Psychology,' two volumes; 'The Principles of Sociology.' three volumes; 'The Principles of Ethics,' two volumes. Second, 'Essays: Scientific, Political, and Speculative,' definitive edition, two volumes. Third, 'Social Statics,' revised edition, one volume. Fourth, 'The Study of Sociology,' one volume. Fifth, 'Education,' one volume. Sixth, 'Facts and Comments,' one volume. Seventh, 'Various Fragments,' one volume. Eighth, 'The Inadequacy of Natural Selection,' one volume. Ninth, 'Descriptive Sociology.' The last of these works is, in the main, a collection of material prepared by Spencer's assistants, and printed as such, but under Spencer's direction.

In the most general outlines, what is characteristic of the philosophy of Spencer may be sketched as follows: In his theory of knowledge Spencer has many features in common with the classic English empiricism. But this empiricism, in his case, is modified by considerations due to the doctrine of evolution. Knowledge, namely, as he teaches, arises not merely through the experience of the individual, but through the experience of the race, so that, in the individual, inherited intellectual tendencies determine the recognition of certain fundamental truths as certain and unquestionable, so soon as attention is attracted to the matters which these truths express. Thus, mathematical certainties are based upon a kind of evidence which the individual finds to be absolute and unquestionable, but which the experience of the race has molded into their present forms. In consequence, when we inquire into the foundations of knowledge, we meet with certain assurances, which, in our individual cases, are to be tested by what Spencer calls the "universal postulate," namely, "the inconceivability of the opposite." That is, whatever proposition is such that the experiment of trying to conceive its opposite to be true persistently fails, is to be regarded as a primal necessity, and is to be accepted as true. If we ask how the human race came to know this proposition to be true, the answer is, through the inherited effects of experience. But if we ask why the individual must accept it as true, the answer is, simply because the opposite is inconceivable. Among the principles, thus warranted by the "universal postulate," the principle of the "persistence of force" is prominent. The fundamental principles of ethics have a similar foundation.

Since the ultimate source of our knowledge lies in the experience of the race, it is impossible either by individual observation or by means of the inherited effects of experience, to fathom the innermost nature of the real world. We can know only the world as it appears to beings with such an organization as the process of evolution has brought to pass in the case of our race. Any effort to transcend the limitations thus established leads into the region of what Spencer calls the "Unknowable." Yet it would be wrong to endeavor to conceive our world as merely a world of phenomena, or of contents of experience, or to accept any form of idealism. For the test of the "inconceivability of the opposite" assures us, as one of the absolute certainties, that a world of genuine reality, transcending all our experience, both exists and is unknowable to us. It is equally impossible to deny (or rationally to doubt) the reality of such a world and to attempt any positive theory as to what its ultimate nature is. Subjective idealism, denying that the unknowable exists at all, is therefore, according to Spencer, quite unthinkable. But every effort to give a positive account of ultimate reality breaks down by leading us to unavoidable contradictions, such as are involved in attempting to conceive the world in its wholeness, as either finite or infinite, as either caused or uncaused, as either absolute or relative, and so forth.

All such epistemological considerations, however, are for Spencer mere preliminaries. His principal philosophical interest lies on the positive side, namely, in the effort to reduce to unity the laws of the "knowable" world, that

Digitized by Google

's, the laws which govern the phenomena of nature. Such a unification depends, first, upon recognizing the "persistence of force" — a term by means of which Spencer denotes the conservation of energy, as he conceives that fact. In practice, however, Spencer's term "persistence of force" is applied in more various ways than those which are customary in case of the usual doctrine of the conservation of energy. The "persistence of force," used as a principle, guarantees us against accepting miracles, against conceiving anything as occurring counter to strict natural law, against accepting the doctrine of special creation, and so forth. In brief, the doctrine of the persistence of force gives us a view of what may be called the analytic unity of nature, namely, a view of that character which is common to every sort of natural process.

If, however, we turn from the consideration of this most universal aspect of nature to a study of the various types of natural processes which are observable when we consider large masses, or series of natural phenomena, we come hereupon to the principles characteristic of what may be called the synthetic unity of nature, that is, of that unity which appears when we consider the entire lives of organisms, or the histories of races of living creatures, or the history of planets, of solar systems, or, in another realm, of societies. These processes which the persistence of force render possible are of two general types. They are, namely, either processes of evolution or processes of dissolution. Evolution occurs when great aggregations, such as have just been mentioned, appear and grow and become organized. The formation of a stellar system, the solidification of a planet, the gradual building up and diversification of the earth's crust, the growth of a race of animals or of plants, the life history of an individual, or of a nation — these are processes of evolution. Dissolution is the reverse of any of these processes. When an aggregate is disintegrated, dissolved, or otherwise destroyed, when an organization passes away or disappears, we are therefore dealing with dissolution.

Evolution is of course the more interesting of these two processes. It possesses, according to Spencer, two characteristic forms, primary evolution and secondary evolution — the latter being based upon the former, but occurring in less frequent instances, although these instances are very highly interesting and important. The characteristic of the primary evolutions is that they involve "an integration of matter and a dissipation of motion." Such processes occur when masses of matter cool, contract, and solidify — as, for instance, when planets are formed. The processes of secondary evolution are rendered possible by the fact that some of the bodies subject to primary evolution do not merely contract and solidify, but also pass through a stage or a series of stages of their existence, in which they predominantly possess a "plastic" character. "Plastic bodies" are such as are sufficiently free from a close coherence of parts to permit of easy change in consequence of change in their environment, while at the same time these plastic bodies are sufficiently coherent to retain the traces of disturbances which have happened to them. Thus, a mountain range, subject to erosion, not only yields in numerous ways to the action of water and of weather, but retains, in a great variety of ways, the traces of such erosions as have occurred in the past, instead of being swept away at once by a single flood, as a smaller mass might be. Again, a living organism is a plastic body, so full of internal motion, or of stored up energy, as to be greatly and easily disturbed by its environment, while at the same time it is so far possessed of rigidity in its structure and in its way of responding to external influences, that traces of what has happened to it remain, in great variety, and for a long time, or even throughout the life of the organism. The power of an organism to adjust itself to new conditions, in combination with the power to form and retain habits, constitutes the basis for all the higher development of life. All such powers depend physically upon the characteristics of the "plastic bodies," and the process of organic evolution is altogether to be described as due to the accumulation of such secondary evolution as these properties of plastic organisms make possible. Since the brain itself, such as any higher animal possesses, is a plastic body, the result of processes of aggregation, and is itself on the way toward a greater solidification (such as occurs in old age), while the brain, during youth and early maturity, is at once extremely sensitive to disturbances and very apt to retain the results of former disturbance — it follows that the entire evolution of the mind, which so far as the mind is knowable, accompanies the development of the brain, is itself to be described in terms of the properties of the plastic bodies.

In consequence of the fact that evolution, so far as it is a process of the knowable world, is thus a result of "the integration of matter and the dissipation of motion," and, in case of the secondary evolutions, is a result of the formation of the plastic bodies, it follows that all evolutionary processes must possess certain common features. The primary evolution, otherwise called "simple evolution," consists altogether of the formation of "coherent aggregates," such as result whenever bodies solidify and part with their internal energies. The secondary evolution, also called "compound," includes changes that are due to "differences in the circumstances in the different parts of the aggregate." The most notable result of these internal differences is a "transformation of the homogeneous into the heterogeneous." Wherever evolution takes place in a plastic body such increasing differentiation is inevitable, the reason being that the traces of previous changes are retained, and are made the basis of increasing variety, as the traces of new changes are superposed. In the more complex instances of secondary evolution the transition from the homogeneous to the heterogeneous is long continued and extremely complicated. It is exhibited not only in the structure of an aggregate, but in the functions which belong to this aggregate, in case the aggregate is, like a living organism, the seat of a great variety of energies. The increasing complication and differentiation of the functions and habits of a living organism is thus the result of the same kind of process as makes its appearance even in inorganic nature wherever the results of former changes accumulate in a plastic body. Wherever integration and increasing heterogeneity are long

Digitized by Google

continued and important, they are also accompanied by an increasing definiteness of structure and function, which Spencer describes as due to the process called by him "segregation." Segregation is exemplified wherever the outlines of things grow sharper, wherever the like things of the natural world tend to be grouped near together, or the unlike things to be kept apart. For certain natural forces, whose presence in the world Spencer extensively illustrates, are working along with whatever tends to differentiate phenomena and are so working as to tend to sort out, or to segregate, like, and unlike things. Such forces are manifest in the case of the formation of geological strata through sedimentary deposits, and in the case of the grouping together of similar organisms in societies, and in large numbers of other instances. Segregation combines with differentiation, and with integration, to characterize the whole evolutionary process.

As has just been suggested, Spencer also applies these principles to explain the laws of social structure and function, and to describe the evolution of society, and his especial interest in all these considerations lies in his attempting to make clear the unity of the evolutionary processes, whether organic or inorganic.

The application of the evolutionary formula to the study of psychology has already been in general indicated. Mental functions grow in a way that is precisely parallel to the growth of certain organic structures and functions. Consequently integration, differentiation, and segregation can be traced in mental life as well as in organic life. And in so far as the conditions of mental life are knowable at all, these conditions have to be defined in the terms of the same evolutionary formula which apply to plastic bodies in general, that is, to their structure and to their functions. In order to apply these considerations to that study of ethical problems which so early interested him, and to the defence of those social doctrines which he so early emphasized, Spencer laid especial stress upon naturalism in ethics, that is, upon the necessity of consulting the natural conditions of organic life in order to define the norms of conduct. Conduct is an evolutionary phenomenon and is to be considered in the light of the general formula for evolution. Conduct, for instance, is a part of the adjustment of the organism to its environment, and is to be judged in the light of the laws of that adjustment. That conduct which secures the most perfect adjustment is at once the most acceptable to society, and, by virtue of the conditions under which mind has developed, is in the long run most satisfactory to the individual concerned. For in case of the human organism, the adjustment of internal to external conditions normally occurs in society. Hence such adjustment as keeps the individual in harmony with his social order is conduct of the type favored by evolution. The inherited effects of experience appear in those of our instincts which fit us for harmonious social life. On the other hand, social harmony does not mean social subordination. The goal of social development is a condition of equilibrium in which the individual is as little interfered with by his society as possible, in so far, namely, as interference would involve coercion or restraint. Meanwhile, as this goal is approached, the individual grows increasingly differentiated in his social functions, better adapted to a wider and wider range of social conditions, and more definite in his functions.

Notable in Spencer's work has been his attitude toward the problems of past and of contemporaneous religion. The religions of the world are the results of evolutionary processes whose knowable aspect Spencer elaborately discusses in his 'Sociology.' Viewed as to their contents, they have always included efforts to transcend the bounds of human experience, in a word, to transcend the knowable. But in recognizing the existence of an unknowable, the synthetic philosophy, as Spencer maintains, has itself, in a measure, justified one of the deepest religious interests, namely, the interest of finding ourselves in some sort of relation to a power which, inscrutable though it may be, is still ever-present and is the source of all things.

In his 'Essays on Education' Spencer has made prominent the importance of the study of natural science, and has emphasized the significance of the sort of training which he himself originally received from his father.

In sum, Spencer was one of the leaders of the age in which the modern doctrine of evolution came into prominence. In his own development he was, until 1860, when he first became acquainted with Darwin, substantially independent of other evolutionary thinkers, at least among his contemporaries. Indirectly, and somewhat unconsciously, he was influenced (as Professor John Dewey has pointed out) by the tradition of 18th century French philosophy; consciously he was molded by the English liberalism of his time; and less prominently he was affected by the Kantian epistemology, with its limitation of human knowledge to the phenomenal world. The Kantian influence was indirect, occurring through Spencer's reading of Hamilton and of Mansel. Spencer's popular influence has been very large — still larger in America than in England. His most notable undertaking is the effort to formulate the doctrine of evolution in general terms; as a part of the undertaking, his work in psychology, in sociology, and, to a less degree, in educational theory, and in ethics, has proved widely influential.

Bibliography.— Mr. F. Howard Collins has written an 'Epitome of the Synthetic Philosophy,' authorized by Spencer himself. Spencer's 'Autobiography' has already been mentioned. The present writer has attempted a brief estimate and review of Spencer's contribution to the concept of evolution in the volume entitled 'Herbert Spencer,' published in 1904, and containing also personal reminiscences of Spencer by James Collier.

Josiah Royce,
Professor of Philosophy, Harvard University.

Spencer, Jesse Ames, Protestant Episcopal clergyman, author, and educator: b. Hyde Park, N. Y., 17 June 1816; d. Passaic, N. J., 2 Sept. 1898. Having graduated from Columbia University and completed in 1840 a course in theology at the General Theological Seminary, he entered the ministry, becoming rector of Saint James Church, Goshen, N. Y., where he remained for two years. He then became professor of Latin and Oriental languages at Burlington College, 1849–50; accepted the position of

Digitized by Google

editor and secretary of the Episcopal Sunday School Union and Church Book Society, serving from 1851–7; for two years, 1863–5, was rector of Saint Paul's Church, Flatbush, L. I.; and from 1869–79 was Greek professor in the College of the City of New York, and profesor emeritus, 1879–81. He published: 'The Christian Instructed in the Ways of the Gospel and the Church' (1844); 'History of the English Reformation' (1846); 'The East: Sketches of Travel in Egypt and the Holy Land' (1850); 'History of the United States from the Earliest Period up to the Death of President Lincoln' (1856–69); 'Greek Praxis' (1870); 'The Young Ruler who Had Great Possessions' (1871); Pycroft's 'Courses in English Reading' (1873); 'Sketch of the History of the Protestant Episcopal Church in the United States' (1878); 'The Lost Five Things: Studies in Eschatology' (1887); 'Memorabilia: Recollections of Sixty Years, 1826–86' (1890); etc. He also edited six volumes of Arnold's series of Greek and Latin text-books (1846–50); 'New Testament in Greek, with Critical and Exegetical Notes on the Gospel and the Acts of the Apostles' (1847); 'Cæsar's Commentaries' (1848); Trench's 'Poems' (1856); Crosby's 'Xenophon's Anabasis' (1875); 'The Young Churchman's Miscellany' (1846–68); etc. In 1883 the House of Bishops appointed him custodian of the Standard Bible.

Spencer, John Canfield, American lawyer: son of Ambrose Spencer (q.v.): b. Hudson, N. Y., 8 Jan. 1788; d. Albany, N. Y., 18 May 1855. He was graduated from Union College in 1806, was private secretary to Governor Tompkins in 1807–9, and in the latter year was admitted to the bar. In 1811 he became master in chancery, was appointed judge-advocate-general on the northern frontier in 1813, and assistant attorney-general of New York in 1815. He served in Congress in 1817–19, was a member of the State assembly in 1819–20, acting as speaker in the latter year, and in 1824–8 he was State senator. He was one of the commissioners to revise the statutes of the State of New York and was special attorney-general in the prosecution of the Masonic murder of William Morgan (q.v.). In 1839–41 he was secretary of state and superintendent of common schools and in the last named year was appointed secretary of war by President Tyler. He was transferred to the treasury department in 1843, but resigned in the following year because of his disapproval of the annexation of Texas. He thereupon resumed his law practice, was afterward a member of various State commissions, was actively instrumental in introducing an improved common school system, and the organization of the State asylum for idiots was due largely to his efforts. He edited, with preface and notes, Henry Reeve's translation of Tocqueville's 'Democracy in America' (2 vols. 1838), and was joint author of 'Revision of the Statutes of New York' (3 vols. 1846). Consult Proctor, 'Review of John C. Spencer's Legal and Political Career' (1886).

Spencer, Joseph, American soldier: b. East Haddam, Conn., 1714; d. there 13 Jan. 1789. He entered the Northern army in 1758, rose to the rank of colonel, and in 1775, at the suggestion of Washington, was appointed brigadier-general by Congress. He took umbrage at the promotion of Gen. Israel Putnam and was about to withdraw from the army but decided to remain and served around Boston until its evacuation. He was then transferred to the defense of New York, promoted major-general in 1776, and in 1778 he was placed in command in Rhode Island. He assembled his forces at Providence, but after several weeks his proposed movement against the British at Newport proved a failure and the militia was disbanded. He was severely censured for his part in the failure of the expedition but was acquitted by the court of inquiry. He resigned from the army upon the order by Congress for an investigation and thereafter lived in retirement.

Spencer, Joseph William, American geologist: b. Dundas, Canada, 26 March 1850. After graduating from McGill University, Montreal, in 1874, where he took first honors in geology and mineralogy, he studied at the University of Göttingen, Germany, whence he was graduated Ph.D. in 1877. In 1877 he was appointed science master at the Collegiate Institute at Hamilton, Ontario; in 1880 became vice-president and professor of geology in King's College, Nova Scotia; in 1882 accepted the chair of geology in the University of Missouri, remaining there till 1887; and was State geologist of Georgia from 1888–93. He designed the museum building for the University of Missouri and procured many of the specimens for the geological department. In 1893, having come to New York, he became dissatisfied with the technical publications of the experimental stations and induced the legislature to appropriate $8,000 for university extension of agriculture, the money being placed with Cornell University, part for carrying the Agricultural College to the farmer and part for the Experimental Station. In 1896 he was placed in charge of the department for a farmer's correspondence reading course and later, with the aid of the Department of Public Instruction, succeeded in introducing agriculture under the name of "nature study" into the public schools. He has written: 'Niagara Fossils' (1884); 'Glacial Erosion in Norway' (1887); 'Geological Survey of Southwestern Georgia' (1891); 'Geological Survey of the Paleozoic Belt of Georgia' (1893); 'Origin of Niagara Falls and History of the Great Lakes' (1895); etc.

Spencer, Platt Roger, American penman: b. East Fishkill, N. Y., 7 Nov. 1800; d. Geneva, Ohio, 16 May 1864. At 15 he taught his first writing class; and from 1816–21 was employed as a bookkeeper. He then studied law and later became a teacher in the common schools. He was instrumental in the establishment of business colleges throughout the United States, and published 'Spencer and Rice's System of Business and Ladies' Penmanship'; 'Spencerian or Semi-Angular Penmanship.' What is known as Spencerian penmanship derives its name from him as its exponent.

Spencer, Sara Andrews, American social reformer: b. Savona, Steuben County, N. Y., 21 Oct. 1837. She was graduated from the Saint Louis Normal School, 1856, and was married to H. C. Spencer in 1864. Having removed to Washington she with 72 other women attempted to register and vote in 1871 but was refused. She then brought suit which resulted in decisions of the Supreme Court of the District of Colum-

Digitized by Google

bia and the Supreme Court of the United States that women could not vote without local enabling legislation. She was instrumental in the passage of a bill in the District of Columbia, 1873, for the rescue of outcast girls, and was secretary of the National Woman Suffrage Association 1874-81 and president of the Woman Franchise Association of the District of Columbia 1871-76. She has published 'Problems of the Woman Question;' 'Thirty Lessons in the English Language.'

Spencer, Iowa, city, county-seat of Clay County; on the Little Sioux River, and on the Chicago, Milwaukee & St. Paul railroad; 75 miles northwest of Fort Dodge and 80 miles northeast of Sioux City. It is in an agricultural and stock-raising region. Its chief industries are connected with farm and dairy products. It is the commercial centre of nearly all of Clay and the adjoining counties. It makes large shipments of corn, wheat, live-stock, vegetables, and dairy products. There are a high school, public elementary schools, a private commercial school, and a library. The two banks have a combined capital of $125,000. There are two private banks. Pop. (1910) 3,005.

Spencer, Mass., town, one of the county-seats of Worcester County; on the Boston & Albany railroad; about 12 miles west of Worcester. It is in a beautiful region, about 1,000 feet above sea-level and surrounded by farm lands. It was settled in 1717 by Nathaniel Wood. Originally it was a part of Leicester, and in 1744 it was made the West Parish of Leicester, and in 1753 was incorporated as a town with the name of Spencer. In 1744 its first church was organized. It has a large boot and shoe factory, woolen mills, vinegar works, and wire works. The boot and shoe factory is said to be the largest in the world. There are seven churches, the David Prouty high school, public and parish elementary schools, and the Richard Sugden Public Library, opened in 1857. There are a national and a savings bank; the national bank has a capital of $100,000. The government is administered by a board of five selectmen. Pop. (1910) 6,740.

Spencer Gulf, Australia, a large inlet of the Indian Ocean indenting the south coast of South Australia between Eyre and York Peninsula. Fifty miles wide at the entrance, it widens to nearly 100 miles, and then narrows gradually into a fiord at Fort Augusta, nearly 200 miles inland.

Spence's Metal, a substance made by melting together a metallic sulphide with sulphur. It can be colored to imitate bronze and other metals. Spence's metal was first made in 1879.

Spen'der, James Alfred, English journalist and author: b. Bath, Somerset, 1862. He was educated at Balliol College, Oxford, was editor of 'Eastern Morning News,' Hull, 1886-90, and in 1893 became assistant editor of the *Westminster Gazette,* a Liberal paper then founded. He has been its editor since 1896 and has published an important work on 'The State and Pensions in Old Age'; and 'The New Fiction and Other Papers.'

Spen'love-Spen'love, Frank, English painter: b. Sterling, Scotland, 1866. At the Paris Salon his 'Funérailles dans les Pays Bas' was awarded the gold medal of Paris, and purchased for the Luxembourg (1901). He exhibited at the Royal Academy for the first time in 1886 and has been represented there every year since. Among his landscapes and genres may be mentioned: 'After Summer Days'; 'Night's Awakening'; 'Gilded Pastures'; 'Over the Valley'; 'Avenues of Gold'; 'Picardy'; 'The Hurrying Storm'; 'A Winter's Tale—Funeral Blessings, Holland'; 'Unto This Last—The Pilot's Funeral'; 'Too Late'; 'Darsham Vale'; 'Autumn Glory'; 'The Little White Cross'; 'Grey of the Morn'; 'In the Shadow of the Church'; etc.

Spenser, Edmund, English poet: b. London (probably in East Smithfield near the Tower) ca. 1552; d. Westminster, 16 Jan. 1599. He was the eldest son of Elizabeth (cf. 'Amoretti,' LXXIV) and (perhaps) John Spenser, "free journeyman" in the "arte or mysterie of clothmakynge," in 1566 with one Nicholas Peele, "sheerman" in Bow Lane. A "John Spenser, son of John Spenser, gent.," known to have followed the poet through the same school and college, may have been a younger brother. In the Burnley district of N. E. Lancashire there was a family of Spensers, among whom the names John, Edmund, Lawrence were common. The poet had a son Lawrence. Edmund also shared in the benefactions of Dean Nowell, relative by marriage of the Lancashire Spensers.

This commonplace upcountry stock hardly invited celebration from the ambitious Court poet; but *the* Spencers of Althorpe, Northamptonshire, were a kinsfolk to be claimed and proclaimed. And, after 1590 at least, three daughters of Sir John Spencer, head of that "house of auncient fame," acknowledged and patronized their now famous, if still impecunious connection; he in return is profuse with dedication and complimentary allusion. To one, Elizabeth, Lady Carey, he writes, dedicating 'Muiopotmos': ". . . . I have determined to give myselfe wholy to you, as quite abandoned from myselfe, and absolutely vowed to your services." No doubt solely on the strength of this "platonic" vow, Nashe two years later (1593) assured Lady Carey in his dedication of 'Christs Tears over Jerusalem' that "Fame's eldest favorite, Maister Spenser, in all his writings he prizeth you."

To his father's association with the Merchant Taylors' Company, and to Dean Nowell's help, Spenser apparently owed an excellent education. The recently (1561) founded Merchant Taylors' School offered free tuition to 100 poor boys, and the "free journeyman's" son was doubtless one of these. Later, at Pembroke College, Cambridge he matriculated 20 May, 1569, as a "sizar," or student who for certain services was exempted from fees and given board and clothing. Moreover, Dean Nowell's accounts (ed. Grosart, 1877) show several gifts of money from 1569 on; and already in 1569 Spenser was earning money himself. At least, certain sonnets included by Ponsonby in the 'Complaints' of 1591 are manifest revisions from a certain 'Theatre for Worldlings' of 1569. This was an English translation of a Protestant polemical miscellany by a Flemish refugee physician, John Vander Noodt, resident at Christ Church school, and very likely known to Mulcaster, master of

Digitized by Google

Merchant Taylors' School. Mulcaster's boys were especially trained in Italian and French, and young Spenser may well have been recommended to Vander Noodt for the job. Moreover, Spenser was almost certainly behind Ponsonby in the publication of the 'Complaints;' and abundant internal evidence makes for the authenticity of the translated sonnets. These are from the 'Songe' added to Du Bellay's 'Antiquitez du Rome,' and Marot's version in sonnets of Petrarch's *canzone* «Standomi un giorno, solo, alla fenestra.» They illustrate interestingly the early maturing of the poet's elegiac Puritanism, stately archaic diction, and flexible verse. Though rhymed for the 'Complaints,' the Bellay «sonnets» of 1569 are in a blank verse better modulated than any other between Surrey and Marlowe.

Spenser took his B. A. at Cambridge 1573; M. A. 1576. Allowances for protracted illnesses indicate delicate health; but he was clearly an eager, if discursive, student. Following Mulcaster's lead, he read widely Italian and French literature as well as classic, the older English authors—especially Chaucer and Langland, moral and natural philosophy—especially the hybrid Platonism of the period. Harvey's nicknames for him—«Italianate Seignor,» «Your French Monsieurship,» etc.,—recognize his cosmopolitan tastes. Training and temperament made him sharply partisan for the Puritans, whose leader in the University, Cartwright, was driven from his chair of divinity in 1570.

The young Master of Arts probably did not seek a fellowship. Had he failed, his friend Harvey was not the man to have kept silence. More poet than scholar, Spenser doubtless, like other needy Elizabethan poets, looked to place and patron, and became first, it would seem, tutor or secretary in the family of a lady of rank in the «North partes» of England; and was then, upwards of a year later, called by Harvey to Kent «for his more preferment.»

This «Gentlewoman of no meane house» in the «North partes» is the «Rosalinde» of the 'Shepheards Calendar'; and the poet's pretence of blighted passion implies probably no more than regulation «loving» gratitude to lady-patron. He was, as she put it, «her Seignor Pegaso.» Twelve years later, in 'Colin Clouts Come Home Againe,' he defends her against the charge of disloyal cruelty by pretty clear intimation that his «passion» had been but «Platonic» tribute.

The editor of the 'Calendar' says that the name «Rosalinde» «being wel ordered, wil bewray the very name of hys love and mistresse»; and the hint may have enlightened a select few. But the possible anagrams—if anagram is meant—of «Rosalinde» are many; and the «feigned name» seems too good to be a strict anagram. Solutions have been numerous, but unconvincing. That she was a Lancashire «lasse» met by the young graduate on a visit to his relatives there, seems unlikely: an ambitious youth would hardly seek preferment among small farmers in a remote rural corner of England. The asserted Lancashire setting and dialect of the 'Shepheards Calendar' are uncritical myths: setting and language are not local, but literary and composite, artificial rustic («Doric») and conventional «Arcadian.» Moreover, there is Aubrey's statement, on the asserted authority of John Dryden, that «Rosalinde» was a «kinswoman» of Sir Erasmus Dryden's wife, who was a daughter of William Wilkes of Hodnell, Warwickshire, a place not far from the Cotswold Hills. Whatever difficulties may lie in calling these hills «North partes,» at least Drayton, in one of his eclogues, set «Rosalinde» there.

From these «North partes» Spenser was called to become «the Southerne shepheardes boye» in Kent. Through the «shepheard,» acceptedly Sir Philip Sidney, he may presently have been made secretary to Sir Henry Sidney, Lord-Deputy in Ireland. At least, in the 'Veue of the Present State of Ireland' (Globe ed., p. 636), Irenæus, Spenser's general mouthpiece professes to have witnessed the execution of «Murrogh O-Brein,» 1 July 1577.

Two years later, 5 Oct. 1579, Spenser appears in the service of Sir Henry's brother-in-law, Leicester, and writing to Harvey from Leicester House. This letter and another, with Harvey's answers, were published, presumably by Harvey, a year later. They reveal 1579-80 as the poet's *annus mirabilis*. Brimful of publishing projects, eager for literary reforms, received at Court, had «in some use of familiarity» by such high society as Sidney and Dyer, and by pretty women (to sober Harvey's sage alarm),—before the year-end he had achieved the programme of a new poetic school, written its manifesto, and outlined his own chief works to come. Among other projects, he informs his somewhat sceptical friend of a great Continental trip on Leicester's business. Then suddenly, as it seems, all this stops. He arrives in Dublin, 12 Aug. 1580, secretary to the new Lord-Deputy, Lord Grey de Wilton.

Meanwhile, but one of his several finished poems had been printed; and this under a pseudonym, and ostensibly on a friend's responsibility. The 'Shepheards Calendar,' finished before 10 April 1579—date of the editor's epistle to Harvey,—but not «entered» until December 5, appeared soon afterward, embedded in a literary apparatus full of mystifications. Secrecy, however open, was in the «amorist» code. More importantly, the «theological» eclogues expressed opinions close to treasonable, and preferred unpleasant personal charges. The editor, «E. K.,» played his part well, being at times clairvoyant of the author's secret meanings, at other times obtuse as «Ignaro» himself. He was doubtless Edward Kirke, once with Spenser at Pembroke College; but much of the «glosse» must have been inspired, if not dictated, by Spenser himself, who, if perhaps «furre estraunged» in April, was certainly in London in October 1579.

The 'Shepheards Calendar'—perhaps so-called from a popular almanac, the 'Kalender of Shepherdes'—contains, as its sub-title indicates, «twelve aeglogues proportionable to the twelve monethes.» It was dedicated to Sir Philip Sidney. The «aeglogues» are of the Renaissance courtly type, in no proper sense poems of country life. The nature described is «Arcadian»; the description decorative; the real appeal personal and polemical. Tribute to a past patron, «Rosalinde,»—to a present patron, Leicester, in the dirge for his kinswoman, «Dido,»—to a hoped-for patron, the Queen, in the «laye of Elisa»; partisan support of Leicester's Puri-

Digitized by Google

tanism against Burghley's "Anglicanism"; proclamation of his own Platonist poetics—such are the live interests; the rest, as E. K. says, is "recreative," little neo-classic idyls in porcelain. Such "pastoralism" is a poetry, not of nature, but of art,—goldsmith's art for nicety and "curious felicity" of detail. The 'Calendar' is the first English poem which rivals the poetic virtuosity of Renaissance Italy and France.

But "Immerito" justifies his editor's title of the "new Poet" in a larger sense. He appears in the 'Calendar,' like his master Du Bellay in the 'Deffence et Illustration de la Langue Francoyse,' as the spokesman of a school of "new poets"—Sidney, Dyer, Fulke Greville, and perhaps others—who form an "Areopagus," in emulation of the "Pleiade," to promulgate in England the tenets of Du Bellay's and Ronsard's poetic reform. The poet is to be "defended" as an inspired teacher, born not made, but needing "laboure and learning" fitly to understand and to express his high message. By him the common speech must be "ennobled" (*illustrée*) by art into a really "poetic diction," —inversely to Wordsworth's contention. The new poet's method is to be "assimilative imitation" of the classics primarily, but with a judicious eye to the best among modern and national models. Spenser's own pronouncement, 'The English Poete,' was not printed: Sidney may have worked it into his own 'Defense of Poesie,' the Platonist doctrine of which concurs with Spenser's. The question of "classical" metres was discussed by the "Areopagus", as it had been by the "Pleiade"; but the Harvey-Spenser correspondence has exaggerated its importance for the English school.

Spenser aspired early to be the English "Virgil"—the "*poeta novus*" of his own day—and in 1579 had already begun the epic designed to follow his "low-flying" pastoral as the 'Aeneid' followed the 'Bucolica.' Such indeed was, as E. K. says, the common aspiration of Renaissance poets. Du Bellay eloquently demanded for France a "*long poëme*" worthy to stand with the 'Æneid' and the 'Orlando Furioso.' For the Renaissance, however, Virgil was more than the poetic historian of the founding of Rome—the "*romanus Vergilius*" of Petronius; he was also the moral allegorist of Macrobius and Petrarch, and the unwitting Christian prophet of Dante. Spenser's first idea was, apparently, to re-express these patriotic, moral, and religious motifs in the style of the 'Orlando Furioso.'—thus satisfying the eclectic ideal of the new school. In 1579 he sent Harvey a draft of his resulting 'Faerie Queene.' But Harvey was unconvinced by this attempt to "overgo" Ariosto; and Spenser worked away in silence for ten years. Of the 'Faerie Queene' of 1590 Harvey was loud in praise; and in fairness, we may presume a radical recasting.

Until Lord Grey's retirement, August 1582, Spenser was his secretary. By March 1581, he had also purchased from Ludowick Bryskett appointment, with right of deputy, as registrar or clerk of the Faculties of the Court of Chancery in Dublin. He began, too, a series of land-speculation,—first buying, to sell immediately, Abbey Enniscorthy in county Wexford, and an Abbey in New Ross. Next, January 1582, he leased for six years the Dublin residence of the attainted Lord Baltinglass, and secured a "custodiam" of Newlands in Kildare, property of a relative of Baltinglass. On August 24 he leased for 60s. a year "the dissolved house of Friars Minor of the New Abbey, in the county of Kildare, with its possessions"; and resided there at least during 1583-4, when he served as a commissioner of musters for the county. In 1590 his lease of New Abbey was forfeited for non-payment of rent. The Dublin house he used for business convenience: the conversations described in Bryskett's 'Discourse of Civill Life' took place probably in the Spring of 1584 or 1585; and Spenser came daily from neighboring Dublin to join in them. Finally, his name appears in the articles, June 1586, for the Munster "undertakers" or colonizers, as lessee of the castle and lands, 3028 acres, of Kilcolman, in county Cork. Although the patent was not passed until 26 Oct. 1591, Spenser must have taken possession by 1588-9, since in that year he reported six English settlers on the estate, and also received Raleigh as guest. Rent was fixed at £8 13s. 4d. per annum, to be doubled after Michaelmas, 1594; there is record of payment for 1592.

On removal to Kilcolman, he resigned, 22 June 1588, the Dublin clerkship, to purchase, again from Bryskett, clerkship of the Government Council of Munster,—Bryskett, however, apparently reserving a share in the reversion of the office. Spenser, like his master Chaucer, was a shrewd man of business; but his shrewdness had its nemesis. Local feeling ran high against the undertakers. On 12 Oct. 1589, Lord Roche of Fermoy, English-born but Irish by sympathies, charged Spenser with unlawful dispossession of certain lands "by colour of his office and by making of corrupt bargains with certain persons pretending falselie title." This began a series of petty persecutions by Roche,—once by "boycott," making "proclamation" that "none of his people should have any trade or conference with Mr. Spenser or Mr. Piers, or any of their tenants, being English,"—another time, by "fineing" a tenant of his own "for that he received Mr. Spenser in his house as he came from the session at Limerick." Probably for protest against Roche, as well as on Raleigh's invitation, Spenser left for London between October 12, when Roche brought suit, and December 1, when the first three books of the 'Faerie Queene' were "entered."

Since, ten years before, Spenser had boasted of "overgoing" Ariosto, he had grown in knowledge and experience: Bryskett draws him less poet than philosopher. Even in 1579, no two literary temperaments could have been more antipathetic than the Platonizing Puritan of Cambridge and London and the Horatianly cynical, witty Ferrarese. After 1580, the 'Orlando Furioso' remained for Spenser a storehouse of plot and incident and character in silhouette (cf. R. E. N. Dodge, Publ. Mod. Lang. Assoc. Amer., 1897); but for the essential things,—spirit, manner, ideals—Tasso's 'Gerusalemme Liberata' became his intimate model. The later epic better fitted Du Bellay's ideal in its high seriousness—at once religious, moral, and patriotic,—in its form and manner sensitively refined, pictorial, and—as the Renaissance understood the word—classic. Temperamentally, Tasso and Spenser were sympathetic, even—difference of creed notwithstanding—in their sombre religiosity. Elizabeth in 1584 envied the

Digitized by Google

Duke of Ferrara his laureate; Spenser was even then preparing to fill Tasso's rôle in England.

The 'Faerie Queene' was designed to be an allegory, in 12 books of 12 cantos each, of the "ethike part of philosophy" which concerned private conduct; and a sequel was promised, allegorizing political or princely conduct. To add the national note, the hero was to be *Prince* Arthur embodying the private virtues, *King* Arthur the political. The central motive of this virtual "conduct-book" shows the influence of the most famous "conduct-book" of the age, Castiglione's 'The Courtier.' Prince Arthur's mystic love for the dreamed-of Gloriana—the faith whence all his good works spring,—while it has roots in medieval romance, is raised to a power for righteousness by the Neo-Platonism to which, as applied to womanly influence, Castiglione, following Bembo, gave international vogue.

Harmonization of Neo-Platonism with Catholic theology had been a commonplace since Ficino, not to say Origen; Spenser's idea was to harmonize Neo-Platonism with Puritan theology. His method can be seen in the 'Fowre Hymnes': the first pair, composed in the "greener times" of his youth, superbly voice a nearly pure Neo-Platonism of the type of Benivieni; the second pair, 1596, somewhat mechanically transpose the theme to the key of Tyndale and Calvin. Following his eclectic method, Spenser in the 'Faerie Queene' incorporated other doctrinal items, notably Aristotle's doctrine of "moderation" and his moral categories, as already modified by Italian commentators into 12. The allegory of the Puritan's "battle between the Spirit and evil lusts"—error, hypocrisy, pride, despair,—"the chief and principal work of faith, the battle of the Spirit against the flesh" (the "Old Dragon"),—the comforting by divine Truth (Una) of his soul overcome by Despair,—the necessary mediation of divine Grace (Arthur)—all this is already adumbrated in Tyndale's 'Prologue upon the Epistle of Saint Paul to the Romans' (republished in Works, 1573).

Spenser's problem was to express this eclectic system through a romantic narrative itself constructed from many sources—Classic, Mediæval, Renaissance—the personages of which should represent its categories, and their ordered adventures its dialectic; and, at the same time, also to "shadow forth," as through a double veil, the religious, political, and contemporary social history of England. No other European poet except Dante had essayed so prodigious a task; and Spenser *may* have been emulating Dante. But the English poet was infinitely less happy in his medium: the cloudily shifting scenes, monotonous ill-motivated exploits, vaguely or externally differentiated characters of popular chivalric fiction offered but a poor substitute for the Tuscan's accurately symbolic, yet localizable and tangible other world of nicely discriminated human realities.

The curiously protean poem, however, even in its weaknesses, was nicely calculated to contemporary taste. It had something for all,—high if vague doctrine for thinkers,—classical learning and Italianate elegance for scholar and dilettante,—romantic story, graphic picture, piquant gossip for courtier or fine lady; and the cultivated Elizabethan often united in himself all these moods. Spenser was at once acclaimed supreme poet of his generation. Exception may have been taken by some, as by Jonson, to the artificially archaic diction—attempt, on Pleiadiste principles, to dam up current speech at its Chaucerian "well of English undefyled," or to the complicated stanza, itself probably also from Chaucer—the 'Monkes Tale' stanza capped by an Alexandrine; but no English poet, unless Chaucer, has been in his lifetime so undissentingly lauded.

In February 1591, an annual pension of £50 was allotted, a stipend—if paid!—worth several times that of the present Laureate. Spenser was probably disappointed, however, for another reason. On his own testimony (especially, F. Q. VI. xii. 41) and that of contemporaries, his writings had angered all-powerful Burghley. Puritan Leicester's partisan and protégé, Spenser had lost no opportunity to attack the policy, as well as by innuendo to insult the character of Leicester's lifelong opponent. No contemporary could have failed to find Burghley among the "bigge Bulles of Basan" of the "September" eclogue (l. 124), or in the arraignment of official "graft" of 'Mother Hubberds Tale' (ll. 515 ff.), or in the libel of "counsellor" Fox (*ib.* ll. 1127 ff.), or in the jealously mean-spirited minister of the 'Ruines of Time' (ll. 447 ff.). From a hostile viewpoint, the cap fitted. Even loyal Harvey later ("Fowre Letters," ed. Grosart, I. pp. 164-5), regretted that "Mother Hubbard, in heat of Choller, forgetting the pure sanguine of her sweete Feary Queene, wilfully overshot her malcontented selfe." Apparently both 'Mother Hubberds Tale' and 'The Ruines of Time' were suppressed or "cald in againe" (cf. Pref., 'Father Hubberds Tales,' 1604; John Weever: 'Epigrams,' 1599). Burghley, long-suffering with Leicester himself, may well have blocked preferment in England for Leicester's "man." Such seems to be the veiled grievance of 'Virgil's Gnat': Spenser ("Gnat") for serving Leicester ("Shepherd") against Burghley ("Snake") is sent off to Ireland ("waste wilderness. . . Cimmerian").

Spenser remained in England until after the beginning of 1591. 'Daphnaïda' was dedicated from "London, this first of January, 1591." The date is undoubtedly "New Style." The lady, Douglas Howard, whose death is lamented, died late in 1590; and the dedication of 'Colin Clouts Come Home Againe' to Raleigh "From my house at Kilcolman, the 27 of December, 1591" circumstantially proves Spenser's return. Assumption of a dramatic fiction in the latter dedication (cf. P. W. Long, N. Y. *Nation*, 1 Nov. 1906) is uncalled for: use of "New Style" dating is by no means uncommon among literary Elizabethans; Gascoigne as early as 1575 appears to have used it side by side with "Old Style" (cf. J. W. Cunliffe: 'Supposes and Jocasta,' Boston, 1906, p. vi, n. 1); Jonson used it mainly; in the 'Shepheardes Calendar' and in 'Amoretti' IV, Spenser starts the "new yeare" with January. The 'Daphnaïda', perhaps built on the lines of Chaucer's 'Boke of the Duchesse,' is itself a "funeral complaint" set in a "vision," and in the falsetto key of hired mourning; its representation of the hapless lady by an heraldic pet lion is a monumental piece of bathos.

A collection, entitled 'Complaints,' "entered" 26 Dec. 1590, appeared 1591. The poems were

Digitized by Google

mostly earlier ones, revised, and were possibly published before. Of the 'Ruines of Rome' and 'Mother Hubberds Tale' there is a MS. extant decidedly varying from Ponsonby's text (Brit. Mus. Add. MS. 34064; cf. 'Mod. Lang. Notes,' XXII, No. 2). Ponsonby's foreword, accepting responsibility for the volume, and referring to Spenser's "departure over sea," would naturally indicate that the collection was "made up" in the author's absence. But Spenser was certainly in England when the book was "entered"; and Ponsonby would hardly have "pirated" from his best client. Doubtless Ponsonby's foreword, like E. K.'s "glosse," was a "blind" to avert possible consequences from such plain speaking as the 'Complaints' contained.

The common motif of these is that of mediæval "tragedy,"—the ever turning of Fortune's wheel and the upsetting of great expectations. The theme, modified by the antique notion of "Fate," still dominated the Renaissance imagination, inspiring in England the huge 'Mirror for Magistrates,' the "chronicle-history" plays, and much more, including Vander Noodt's 'Theatre' itself. Too much may therefore be inferred as to Spenser's own temperament from such fashionably melancholy meditations. There is indeed strong personal feeling in them, certainly grief for Sidney and animosity against Burghley, but much is conventional literary exercise. The 'Ruines of Time' follows in scheme the 'Ruines of Rome,' translated from Du Bellay; the 'Visions of the Worlds Vanitie' echo the 'Visions' from Du Bellay and Petrarch; 'Muiopotmos' is an airier variation on 'Virgils Gnat,' translation of the pseudo-Virgilian 'Culex'; the idea of the 'Teares of the Muses' had already been developed in Ronsard's 'Dialogue entre les Muses deslogées et Ronsard' and in Harvey's more personal 'Musarum Lachrymæ'; 'Mother Hubberds Tale' is an adaptation of 'Reynart the Foxe' with Renaissance accretions (cf. E. A. Greenlaw, 'Mod. Philol.,' Chicago, Jan. 1905).

'Colin Clouts Come Home Againe,' although its dedication is from Ireland, may have been written and disseminated in MS. while Spenser was still in London. The eclogue is a kind of poetic "P. P. C." to the poet's English hosts,—Colin telling his rustic companions about Kilcolman, of the lights—and shadows—of the Court over sea. But "Hobbinol" (usually Harvey) was certainly in England. The whole piece is a model of subtly modulated compliment, scaling up to the platonic homage to Spenser's royal mistress, then resolving into the minor of the apology for his "rustic" mistress. The eclogue was printed with 'Astrophel,' 1595.

Shortly after Spenser's return to Kilcolman, he fell in love; and after more than a year of courtship, married 11 June 1594, Elizabeth Boyle, "cozen" of Richard Boyle, later first Earl of Cork. "Elizabeth's" identity is established from Boyle's memoirs ('Linsmore Papers,' ed. Grosart, 1886-8), in which she appears as mother of Peregrine Spenser and wife of Roger Seckerstone, whom she had married in 1603. In 1613, again a widow, she married Captain, later Sir Robert Tynt. The kindlier tone towards Ireland of Spenser's later poetry indicates domestic happiness.

On 19 Nov. 1594, five months after Spenser's wedding, Ponsonby "entered" the "Amoretti and Epithalamion written not long since by Edmunde Spenser," and issued the volume, 1595, ostensibly on his own initiative; but his vague foreword implies that he had received the MS. from the author himself. The titular coupling of the two pieces must have suggested their dramatic connection, four little neo-classic idyls serving as a "recreative" *entr'acte*. Both describe in identical terms one heroine, stately to haughtiness, rosy-cheeked, golden-haired, blue-eyed. After the traditional sonnet-cycle formula—"the prologue, hope; the epilogue, despair"—the 'Amoretti' close with a lovers' quarrel, allusion to which may lie in "the paynes and sorrowes past" of the 'Epithalamion' (l. 32). Phrase and conceit are imitative; but—one may go a-wooing with conventional manners in a borrowed coat. In form, the schema of "linked" quatrains compromises between the close-knit Italian sonnet and the loose Shakesperian. The gorgeous 'Epithalamion,' redeemed from mere goldsmith's work by its exuberant feeling, follows not unworthily the Italian *canzone*. To these two "goodly ornaments" for his bride, Spenser added a charming pendant in the idyl of Colin piping to his "countrey lasse," a fourth Grace in the midst of Venus' damsels (F. Q. VI. x).

The "poet-undertaker" had been having other troubles besides the doubts and delays of his long courtship. He was again sued by Roche, and was dispossessed, by default of appearance, 12 Feb. 1595 (N. S.), of three "plough lands, parcell of Ballingrote." To conduct his case, he assigned his clerkship of the Munster council to one Nicholas Curteys, who thereafter, "upon the trust of Lodowick Bryskett and Edmund Spenser," retained the "poor and troublesome place" until superseded by Richard Boyle, February 1598.

The second three books of the 'Faerie Queene' were finished by 1594 ('Amoretti,' LXXX). Spenser must have carried the MS. to Ponsonby between February 1595, when he appeared against Roche, and 20 Jan. 1596, when the poem was "entered." He dedicates his 'Fowre Hymnes' from the Court at Greenwich 1 Sept. 1596. On November 8, he attended—as his 'Prothalamion' for it implies—the double wedding at Essex House between the Earl of Worcester's daughters, Elizabeth and Catherine Somerset, and Essex's friends, Henry Guildford and William Petre.

Now that his old patrons—Sidney, Leicester, Grey—were all dead, Spenser was courting Sidney's widow's husband Essex, of whom the 'Prothalamion' is principally a panegyric. Meanwhile, the 'Astrophel,' an elegy for Sidney—with companion-pieces by other hands,—had appeared with 'Colin Clouts Come Home Againe,' 1595. One piece, Bryskett's 'Mourning Muse of Thestylis,' had been separately "entered" 22 Aug. 1587; and possibly, the whole series was resurrected for sake of the dedication to Lady Essex. Her acceptance of a poem celebrating Sidney's "amour" with Lady Rich further testifies to the purely "platonic" nature of that "amour."

These publications of 1595-6 emphasize the poet's growing worldliness. Sharp-tongued radical moralist gives place to polished and discreet court laureate—by assumption if not appointment. Nobility for him is rather of caste than of character: "court and royal citadell" are

Digitized by Google

"the great school-maistresse of all courtesy" (F. Q. III. vi. 1.) Most of his work is "occasional"; even in the later books of the 'Faerie Queene' itself, his mirror is held up less to universal humanity than to the Court; historical and personal allusions multiply, relatively crowding out the moral allegory. Book V. is part *apologia* for Lord Grey, who had died in 1593, part chronicle—often *chronique scandaleuse*—of national and social affairs "writ to the meridian" of Hampton and Greenwich. The libel on Mary of Scots as "Duessa" brought from King James, 12 Nov. 1596, a demand for legal redress. As art, however, the best of this later work realizes to the full the Italianate Renaissance ideal of sensuous grace (*leggiadria*),—brilliant dissolving views drawn in "an easie running verse with tender feet."

More touched with abstract thought are the two cantos and a fragment, perhaps part of a book on 'Constancy,' and first printed in the folio works, 1609. Influenced by Bruno's 'La Bestia Trionfante,' "Nature's" overthrow of "Mutability" has a touch of pantheism not quite in harmony with the rest of Spenser's frankly patchwork system. The underlying intention may be a side thrust at governmental "mutability" in Irish policy, parallel to the indictment in the 'Veue of the Present State of Ireland.' This was first printed by Sir James Ware in 1633, but endorsed by Spenser "*finys 1596*," and "entered" by Mathew Lownes, 13 April 1598. By implication of the opening sentence, it was written in England. In the dialogue, Eudoxus, the "wisely docile," is convinced by Irenæus, the "peace-lover," that distraught Ireland needs "violent medecynes"—Machiavelli's "*medicine forti*." The treatise was disseminated in MS. copies, of which several are extant. Later, early in December 1598, Spenser, a fugitive at Cork, used Tyrone's disastrous uprising as an object-lesson for the Queen of his 'Veue,' in 'A Briefe Note of Ireland,' with "Certaine points to be considered of in the recovery of the Realme of Ireland." In 1657, "Iron" Cromwell found in Spenser's sympathetic 'Veue' reason for maintaining Spenser's grandson in possession of Kilcolman.

On 30 Sept. 1598, Spenser was made Sheriff of Cork. Less than a month later, Tyrone's rebels burned his house over his head; he and his family fled for their lives to Cork. Whether or no was added the horror of "a little child new born" perishing in the flames, as Jonson told Drummond, the shock and later privations undoubtedly broke the poet's frail constitution. He sailed, December 9, with despatches from Sir Thomas Norreys, President of Munster, to the Privy Council; delivered these December 24; on Saturday, 16 Jan. 1599, died at Westminster, —according to Jonson, "for lake of bread in King Street," having declined Essex's aid. Jonson may have exaggerated; but contemporaries agree that the circumstances of his death were tragic.

He was given a sumptuous funeral—at Essex's expense, Camden says; and Browne, in 'Britannia's Pastorals,' declares that money given by Elizabeth for a monument, was misappropriated. The present monument, restored in 1778, was erected by Anne, Countess of Dorset, in 1620.

The commingling of classic and romantic elements in Spenser's poetry has led—as with the Pleiade—to a curiously fluctuating appreciation. To his own age another "Virgil," Spenser seemed to the "Augustan" age a barbarous "Goth," to the Romanticists a genius full of glamor and witchery, to later Realists a brilliant, but uneven, word-painter. Each appreciation was justified from its own viewpoint. Milton valued the "teacher"; D'Avenant and Dr. Johnson patronized the evoker of pretty, but distempered, visions. The Jacobeans—the three Fletchers, Browne, Basse, More, Joseph Beaumont, Bunyan, Cowley—read and imitated Spenser, as Jonson recommended, mostly "for his matter," writing didactic allegories in heroic or pastoral vein. Milton and Dryden acknowledged him their spiritual master. Prior opened a long series of external imitation in form—verse and archaism. With Thomson's 'Castle of Indolence' and 'Seasons' begins a richer discipleship, which—sobered by the joint influence of Milton—has lasted to the present day, but culminated in the contemporaries of Wordsworth and Keats. Spenser has amply earned the title of "poet's poet," for his own exquisite art, and for the art begot in others: he has been the "Warwick" of English poets, the poet-maker. His manner has not invited translation: the few German and Italian versions from the 'Faerie Queene' are unimportant. For so great a poet his influence has remained singularly national.

Bibliography.—The fullest life of Spenser is by A. B. Grosart (Vol. I., Complete Works, 10 vols. but 9 issued, 1882 ff). Grosart unearthed much new information; but his enthusiasm often runs away with his judgment. J. W. Hales (Globe ed. Spenser, 1897), and Dict. Nat. Biog., summarizes as established fact most of Grosart's inferences. The most suggestive studies of Spenser's personality as man and poet are by Lowell (1875), R. W. Church, 'English Men of Letters' (1879), and J. J. Jusserand, 'A Literary History of the English People' (Vol. II. 1906). A composite photograph of the three portraits, each of which is from a different viewpoint, is not unlikely to be near the truth.

A critical edition of Spenser's Works remains a desideratum. The Globe text is as good as any. H. J. Todd's variorum edition (1805) is the basis for most following annotations through J. P. Collier's (1859). The 'Faerie Queene' has been separately annotated by Ralph Church (1758), Purves (1872), K. M. Warren (1897), and others; Books I.-II. for school use, by G. W. Kitchin (1868); Book I., more elaborately, by H. M. Percivall (1894); 'The Shepheards Calendar,' excellently, by C. H. Herford (1895). The first edition of the 'Calendar' has been reproduced in facsimile by H. O. Sommer (1890). An 'Outline Guide to the Study of Spenser,' by F. I. Carpenter, Chicago (1894), will be found useful.

J. B. Fletcher,
Professor of Comparative Literature in Columbia University.

Spense'rian Stanza. See Spenser, Edmund.

Sperm-whale. See Whale.

Spermacet'i. See Whale.

Spermatophytes. See Botany; Fungi.

Sper"matozo'on, the male element; one of the flagellated cells developed in the testes (see Testicle) of male animals, and conveyed in

Digitized by Google

their secretion (sperm or semen) to an egg of a female of the same kind, by copulation or otherwise, for the sake of coalescing with (impregnating or fertilizing) that egg, and setting up the developmental changes which result in the formation of a new being. The spermatozoa are extremely minute bodies, nearly always motile, usually slender and whiplike, tapering toward one extremity, and commonly with a rounded head at the other; and are developed by a succession of cell-divisions from certain cells in the testicle, called the primitive male cells, similar in character to the immature ova. The manner in which the spermatozoon unites with the ovum is explained in the article EMBRYOLOGY. It was the belief of a school of naturalists of the 17th century, called «Spermatists,» that the whole of the resulting being was enfolded in and derived from the spermatozoon; while an opposing school asserted that in the egg alone was contained the germ of the animal. (See PREFORMATION.) Neither was right; the birth of the young follows an equal union of both the male and female elements. (See CELL; EMBRYOLOGY); and consult authorities mentioned thereunder.

Sper'rylite, native platinum arsenide, is the only compound of platinum known to exist in nature. It was discovered in 1889 by F. L. Sperry in the concentrates of the Vermilion mine, near Sudbury, Ontario. In 1901 it was found in commercial quantities in covellite at the Rambler mine, Wyoming. It was also reported during the same year in minute quantities in the sands of Cowee Creek, North Carolina. It occurs in minute, isometric crystals, of pyritohedral habit. Fracture conchoidal; brittle; hardness 6 to 7; specific gravity 10.6; lustre metallic, splendent; color tin-white; streak black; opaque. It is a diarsenide of platinum, $PtAs_2$, containing also small quantities of antimony and rhodium.

Speusippus, spū-sĭp'ŭs, Greek philosopher: b. 394 B.C.; d. Athens 336 B.C. After the death of his uncle Plato, he became head of the Platonic school or Older Academy. Of his philosophical works, in which he taught a doctrine differing but little from Plato's, nothing is left but titles and fragments.

Sphacteria, sfăk-tē'rĭ-a̤ (the ancient SPHAGIA), Greece, a narrow island, about 2½ miles long, lying across the entrance to the Bay of Pylos on the southwestern coast of Morea. It is noted for two famous naval battles which took place off its shores, one in ancient and one in modern times. See PELOPONNESIAN WAR and PYLOS.

Sphagnum, a genus of mosses, the only one of the family *Sphagnaceæ,* growing in moist places, or bogs, in such quantities as to form a soft, thick carpet, saturated with water, whence their common name of bog-mosses. They are perennials of feathery aspect growing at the top of the stem from year to year. Some of the numerous lateral branches grow upward, and form tufts at the apices of the stems, while others droop downward and envelop the lower portion of the stem. Each year one of the side branches grows so strongly as to rival the main head, and thus gives a forked appearance to the plant. The lower end of the stem is continually dying away, eventually forming peat, and thus frees the lower ends of the branches, which thereupon start into independent plants. Special branches, differentiated by structure and color, produce the sexual organs, the two sexes being either on the same plant or separated. The spore-capsules are on short branches and are globular, with a lid. The leaves are small, translucent, and, like the stem, have strata of transparent cells, connected by holes, which are capable of absorbing and retaining much water. This ability to retain water has made the sphagnum moss very valuable to florists, who use it for packing bulbs and flowers, and it forms a large part of the compost employed for growing pitcher-plants, and orchids.

Sphal'erite, the commonest ore of zinc. See BLENDE.

Sphere, in geometry, a solid bounded by a surface which is everywhere equally distant from a certain point called the centre. If an arc equal to a semicircle be made to rotate about the straight line joining its extremities, it will generate in space a spherical surface. Any section of a sphere by a plane will be a circle; when the plane passes through the centre the circle of section is a great circle; any other section is a small circle. A straight line passing through the centre and terminating at the surface is a diameter; a straight line from the centre to the surface is a radius. The surfaces of spheres vary as the squares of their radii. If a spherical surface be cut into rings by a set of parallel planes, the area of any ring is proportional to the distance between the two planes which determine it, and the area of the ring is to the total area of the spherical surface as the distance between the two planes is to the length of the diameter.

Spherical Harmonics. See HARMONIC ANALYSIS.

Sphe'rograph, a nautical instrument consisting of a stereographic projection of the sphere upon a disk of pasteboard, in which the meridians and parallels of latitude are laid down to single degrees. By the aid of this projection, and a ruler and index, the angular position of a ship at any place, and the distance sailed, may be readily and accurately determined on the principle of great-circle sailing.

Spheroi'dal State or **Condition,** the state of a liquid when it presents the phenomena caused by placing it on a very hot surface. Leidenfrost observed that a drop of water placed on a very hot surface assumed a spheroidal shape and did not touch the surface. Boutigny made a more thorough study of the subject, and experimented with various liquids. The limit of temperature of the hot surface is the temperature at which the drop of liquid spreads on it and boils with a hissing noise. Boutigny places the limit for water at 142° C., and at 61° C. for ether. The temperature of a drop of liquid in the spheroidal state is always below that at which the liquid boils, and for this reason the interesting experiment of freezing a small quantity of water on a hot platinum dish may be performed. The dish is heated almost to a white heat, when a small quantity of sulphurous acid is placed upon it, and assumes the spheroidal state; the boiling point of sulphurous acid is — 10° C., and in the spheroidal state it is at a temperature less than — 10° C.; a few

Digitized by Google

drops of water added to the sulphurous acid is immediately frozen, and may be thrown out of the dish a mass of ice. Substituting nitrous oxide for sulphurous acid, and mercury for water, mercury may be solidified in the same manner.

That the liquid does not touch the surface is made evident in various ways, such as that of making the surface a flat plate and observing that light passes between the spheroid and the plate, or letting a conducting point enter the spheroid from above, and seeing if a current of voltaic electricity will pass between the spheroid and the dish. The temperature of the spheroid is kept low by the rapid evaporation which is going on at its surface; the spheroid is kept from touching the dish by a cushion of vapor, and this cushion is non-conducting, so that the heat which affects the spheroid is heat radiated from the dish; as soon as the temperature of the dish is less than that competent to provide a cushion of vapor sufficiently dense to sustain the spheroid completely from contact with it, the spheroid spreads on the dish and is quickly dissipated by the heat which it now receives by contact. Consult: Barker, 'Physics' (1893); Daniel, 'Text-book of the Principles of Physics' (3d ed., 1894); Stewart, 'Elementary Treatise on Heat' (6th ed., 1895).

Sphinx, The. The Egyptians called the Sphinx Hu, or Neb (Lord). Its present name is derived from the Greek σφίγξ, Sphinx, «the binder,» «strangler»; from σφίγγειν, *sphingein*, to strangle.

The sphinx, like the obelisk (q.v.), in the mythology of the ancient Egyptians, represented the solar deity, *Ra*, and were originally placed, like the obelisks, in pairs at the entrances of the temples and palaces, not for ornamental purposes only, but mainly for worship. It was emblematical of *Har-em-khu*, «Horus on the Horizon,» the Harmachis of the Greeks, representing the conflict of light and darkness, the conquest of Horus over Typhon, the slayer of his father, Osiris. The Pharaohs of the Middle Kingdom multiplied their number, and placed rows of them on both sides of the principal avenues leading to the temples and palaces of Thebes. The avenues of the temple at Karnac were bordered by hundreds of these sphinxes, many of which still remain, headless and disfigured. Those, however, were not only *andro*sphinxes, but of the *hieraco* and *crio*sphinx type.

All nations of antiquity seem to have held those monstrous beings of various shapes and forms as objects of awe, compelling adoration and worship. The ancient Egyptians believed that the sphinx also represented the Pharaoh who styled himself *Se Ra*, the son of *Ra*. Thus, on the pyramidion of the Obelisk of Thothmes III., in Central Park, there is a figure of that Pharaoh paying homage to a sphinx upon a pedestal, which in itself is a representation of the king. In other words, the king is worshipping himself.

The portals of the rising and setting sun were guarded by those lion deities. Even the Bible speaks of the Cherubim, which were placed to guard the entrance of the Garden of Eden. The real meaning of cherub, however, is still in dispute, but all agree that it was a composite winged being. The prophet Ezekiel describes similar beings in connection with the Divine Throne. The Assyrian conceptions of their guardian deities were chiefly represented by human-headed lions or bulls; eagle-headed human bodies, or *vice versa*.

The sphinxes of the ancient Egyptians were, as already mentioned, of three different forms, namely, (1) *Andro*sphinx, a human-headed lion, symbolizing strength and intelligence; (2) *Crio*sphinx, a ram-headed lion; (3) *Hieraco*-sphinx, a hawk-headed lion.

One of the most imposing relics of ancient Egypt, is the colossal human-headed lion, in front of the second pyramid of Gizeh. Even in its present dilapidated state it elicits the wonder and admiration of the traveler. The Arabian traveler and historian, Abdullatif (1162–1231 A.D.), in his description of the pyramids and sphinx, says: «At a little more than an arrow's flight from the pyramids is a colossal figure of a head and neck projecting from the earth; the name of the figure is '*Abu'l-hol*' » which means «Father of Terrors.» The same authority speaks of it as having excited his attention more than all the other marvelous monuments put together that he had seen in Egypt. «Everything,» he observes, «in spite of its enormous size, was in proportion to nature.» «In a face of such colossal size» he wonders «how the sculptor could have been able to preserve the exact proportions of every part, seeing that nature presented him with no model of a similar colossus, or anything at all comparable.» (DeSacy's trans., p. 180.)

It is at a distance of about 1,800 feet from the Great Pyramid, and is carved from the solid rock upon which it rests. Its dimensions are (Smith's measurements):

	Feet.	In.
Height of head from bottom of chin to forehead	19	
Horizontal diameter on level of forehead	23	
Circumference at level of forehead	72	
Horizontal diameter near broadest part of headgear	29	
Circumference at broadest part of headgear	91	
Height of neck, 5 feet; horizontal diameter	22	
Circumference of neck	69	
Total height of the monument, according to Mariette Bey	65	
Ear	6	5
Nose	5	10
Mouth	7	8
Face, in the widest part across the cheek	13	7
Whole length of body	140	
Outstretched paws	50	

Since Abdullatif's description of its features, the appearance and condition of the sphinx have undergone great changes. The lower part of the headgear and beard are no more. The features, owing to the iconoclastic propensities of the Kopts and Arabs, are no more «gracefully smiling,» as of old; but have a strange, weird expression, amply justifying the Arabic name «Abul'l-hol,» Father of Terrors.

As regards the date of this monument, Egyptologists do not agree. The latest authority, Budge ('History of Egypt,' Vol. II., p. 49), assigns the period of the Great Sphinx to probably one of the builders of the Great Pyramids, but, «it is quite possible,» he adds, «that it may be much older.» Mariette Bey, Maspero, and others attribute it to a much more remote antiquity; to the *Hor-shesu*, the followers of Horus.

The Phœnicians and Greeks imported the sphinx from Egypt and reproduced it in various shapes and forms, of all sizes and of different materials. Some have face and breast of a

Digitized by Google

Digitized by Google

ANDROSPHINX

CRIOSPHINX

Digitized by Google

Digitized by Google

woman, the body of a winged lion and tail of a serpent, and many other varieties, according to the fancy of the artificer and sculptor. These found their way back to Egypt whence they originated, but in different forms.

SAMUEL A. BINION,
Author of 'Ancient Egypt or Mizraïm.'

Sphygmograph, sfĭg'mō-grăf, an instrument for recording the movements of the pulse. The first true sphygmograph was the invention of Vierordt, and has received various improvements. In its most improved form it consists of a small rod which moves vertically up and down, and in so doing communicates motion to a thread passing round two horizontal movable axes, one of which moves a needle that serves as an index, while the other moves a wheel. A pen held in a jointed stalk follows the movements of this wheel, and records its motions on a strip of paper, which is passed beneath it by clock-work. The record has the appearance of a more or less irregularly undulating line. At the lower end of the vertical rod is a small plate, rounded on the lower surface, and when the instrument is in use this plate is brought into contact with the skin above the pulse, which is kept in position by a rest supporting the wrist. Before the instrument is set in full operation the position of the pulse is slightly varied until it is ascertained in what position it gives the strongest impulse to the vertical rod, which is indicated by the index-needle on a graduated scale. Consult Sanderson, 'Handbook of the Sphygmograph.'

Spice-bush, a tall shrub (*Benzoin benzoin*), of the laurel family, frequenting moist woods and the edges of streams. It is conspicuous when leafless on account of its slender branches, and olive-green spotted bark, which has an aromatic odor and taste, suggesting to the Indians, and frontiersmen, its use as a stimulative tea. Very early in spring, the twigs are covered with tufts of honey-scented, tiny flowers, with yellow calyces. They are either polygamous or diœcious, the male flowers having many stamens, and the females a globose ovary and several staminodia. The leaves, which follow, are oval or obovate, and short-pointed. The fruits are ripe in late summer and are oval drupes, bright red in color, and most disagreeable in flavor.

Spice Islands. See MOLUCCAS.

Spices, all those vegetable substances, mostly of foreign origin, having an aromatic odor and a hot and pungent flavor, and used for seasoning food. Cinnamon, cassia, mace, nutmeg, allspice, pepper, cloves, ginger, vanilla, are examples of the principal foreign spices; and cumin, coriander, caraways, fennel, of the native or naturalized vegetable products to which the term is applied. They are obtained from different parts of the plants yielding them; some being the fruit or the kernel or other part of the fruit, some the outer or inner bark, some the root-stock. They owe their odor and flavor to the essential oils they contain. Formerly all foreign spices came from the East by way of Arabia and Egypt, and even yet the great majority of them are of eastern origin, although several are also obtained from America and the islands situated within the tropics.

Spider-crabs, a family (*Maiidæ*) of small, spider-shaped crabs represented by many remarkable and strange forms, some of them of large size, which mostly inhabit relatively deep waters. The shell is generally very hard and on the body bears numerous spines and a prominent beaked process or rostrum in front. The first pair of legs is sometimes larger than the other limbs and always bears pincers, and the rudimentary abdomen possesses seven joints. Many species are found along the coasts of the United States. The best known shallow water forms on the Atlantic coast are two species of *Libinia* (*L. dubia* and *L. emarginata*). The former is especially common along the shore south of Cape Cod, and has the long rostrum deeply divided in front. They are sluggish creatures which make no effort to escape capture, but depend upon their hard covering for protection. Both species are scavengers and subsist upon all kinds of dead animal and vegetable matter. They conceal themselves by attaching sea-weeds, sponges, etc., to their backs, which growing as though fastened to stones, afford them this additional protection. The females, with broad abdomens, are frequently found bearing eggs. The males are larger and often attain a foot in extent. A much smaller flat-bodied species is *Hyas coarctatus*, very common among sponges hydroid and sea-weeds in both deep and shallow water. *Lambrus pourtalesii* is remarkable for the great size of the first pair of legs as compared with the others. It is found in moderately deep water among rocks along most of the Atlantic coast of the United States.

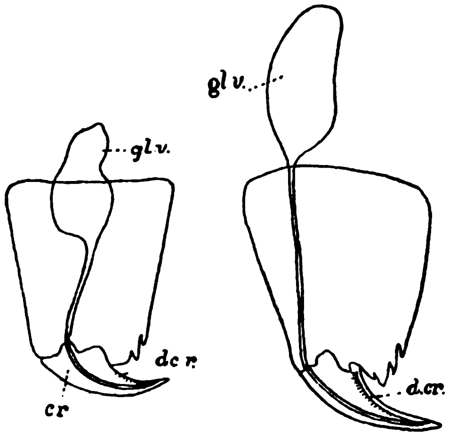
Spider-monkey, a South American monkey of the genus *Ateles*, so called from the great length of the limbs, as compared with the body, and the extraordinary agility of these animals in racing about the tree-tops; no monkeys excel them in adaptation to an arboreal life, in which they are especially assisted by the length and remarkable prehensile strength of their tails. Their structural resemblances to the langurs and other highly arboreal forms of the Old World is interesting; prominent among these is the absence or rudimentary condition of the thumb, a member which is not of great service in swinging from limb to limb, when the tail serves as an effective means of grasping. The fur is usually black, but in some species gray, in one decidedly brown, and in a few Central American species, white on the under surfaces and dark above. They go about in small bands, make little noise, and are often made captive and become confiding and agreeable pets. Probably the best known one is the red-faced spider-monkey (*A. paniscus*), called coaita in Brazil, which has a rudiment of thumb, is very black and extremely intelligent. Although only about a foot in length its tail is twice as long. Others are the chameck (*A. chameck*), 20 inches in length, the sooty-black white-bellied marimonda (*A. beelzebuth*) of Brazil, the grizzled (*A. grisescens*), and the black, yellow, and white variegated spider-monkey (*A. variegatus*), which occurs in the highlands about the headwaters of the Amazon valley. Consult Lydekker, 'Royal Natural History' (1895); Bates, 'Naturalist on the Amazons' (1863).

Spider-shell. See SCORPION-SHELL.

Spiders, invertebrates of the order *Araneæ*, class *Arachnida*. The English name — spider, spinder, spinner, spinster, the spinning one — comes from the function for which these creatures have been chiefly distinguished. They

Digitized by Google

are cosmopolitan in distribution; are found in Greenland, and swarm in the tropics. They show great and striking differences in form and in general habits. The spinning habit also differs widely; as one may see, by comparing the round web of a garden-spider, with the snare of the



Outlines of mandibles to show location of poison sac (gl. v.) and the duct (d. cr.) leading to the opening in the falx, cr.

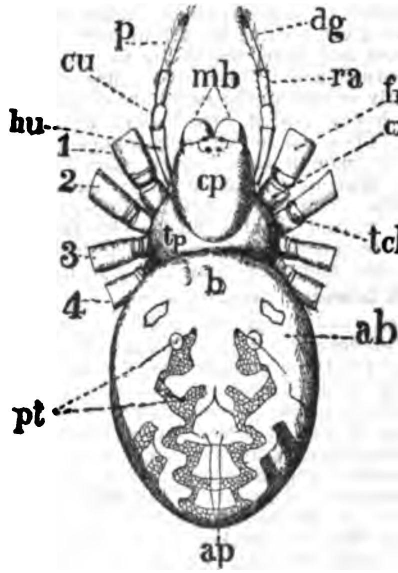
speckled tubeweaver (*Agalena nævia*), made in hedges, fence-rows, roadsides and angles of outbuildings. These typical differences in habit are commonly united with variations in structure, and therefore have been made the basis of scientific classification by the eminent Swedish arachnologist, Dr. T. Thorell, following substantially M. Latraille. In no classification can these functional variations be disregarded; but for the use of the general public such an arrangement is most satisfactory, and is here adopted. Spiders may be roughly divided into two great groups: (1) sedentary; (2) wandering. Sedentary spiders live on or in woven habitations, and take their prey by means of snares upon or near which they habitually stay. They thus have the distinction, almost unique among lower animals, of resembling man in procuring a livelihood by use of manufactured implements. The wandering spiders wholly or in large part hunt their prey afield. These groups may be thus subdivided:

I. *Sedentary Spiders.*—(1) Orbweavers (*Orbitelariæ*), which make open webs circular or partly circular in form, composed of radii issuing from a centre and crossed with spirals armed with viscid beads for the capture of insects; these orbwebs are usually vertical, but some are horizontal. (2) Lineweavers or Netweavers (*Retitelariæ*), whose snares are mazes of crossed lines in the midst of which they hang back downward; our common house and barn cobwebs made in corners or rooms are mostly the product of lineweavers. (3) Tubeweavers (*Tubitelariæ*), which live in silken tubes spun in diverse situations sometimes with a sheeted snare outspreading from the mouth, as the common speckled tubeweaver that nests in hedges, borders and grass. (4) Tunnelweavers (*Territelariæ*), making tubular nests, usually silk-lined, often with extensions above ground; the trap-door spider (*Ctenisa californica*) is our best known type.

II. *Wandering Spiders.* — (5) Citigrades (*Citigradæ*), many of which, as the lycosids, burrow in the ground. (6) Laterigrades (*Laterigradæ*), which live upon plants and among rocks, getting their name from their rapid sidewise movements. (7) Saltigrades (*Saltigradæ*), jumping-spiders, vivacious creatures, with large, bright eyes, living on plants and walls, etc., over which they move by frequent jumps, and among which they make tubular nests of thick white silk.

This arrangement Professor Thorell subsequently modified, dividing the order *Araneæ* into two suborders, *Tetrapneumones*, containing (1) the *Territelariæ;* (2) the *Dipneumones*, embracing all other tribes. M. Eugene Simon, a distinguished French araneologist, retains the two suborders, which he names (1) *Araneæ theraphosæ*, composed of three families, of which the tarantula and trap-door spider are types; and (2) *Araneæ veræ* (38 families), containing all other spiders, divided into two great groups or sections, *Cribellatæ* and *Ecribellatæ*.

Structure.— The early entomologists included spiders among insects, and in popular thought they are still so ranked; but they are widely separated therefrom. The most noticeable differences are: spiders have 8 legs; insects, 6; spiders have the head united to the thorax, insects separated therefrom by a neck; spiders have simple eyes, insects have compound. The spider's body is divided into two parts, cephalothorax and abdomen, united by a straight pedicle or stem. Two mandibles or jaws are attached to the face, each having a hollow fang folded up within a groove when at rest like a pocket-

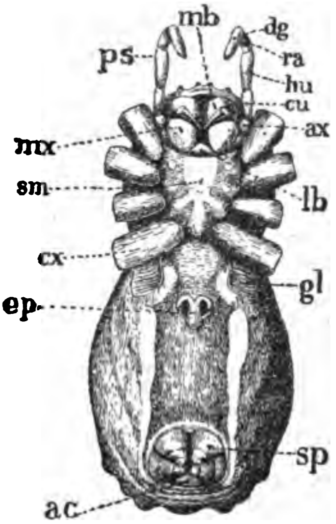


Dorsal view of *Epeira insularis.* ab, abdomen; b, base; ap, apex; pt, pits that mark attachment of muscles; cp, head or cephalic part of cephalothorax; tp, thoracic part; mb, mandibles; 1, 2, 3, 4, the legs in their order, first, second, etc.; tch, trochanter of leg; cx, coxa; fm, part of femur; p, palp; dg, digital; ra, radial; cu, cubital; hu, humeral joints of palps.

knife's blade within its handle. A small opening in the fang communicates through a minute duct with a pear-shaped poison-sac in the upper

Digitized by Google

part of the mandible and head. The poison, as in the case of snakes, is forced out when the spider strikes its victims. On either side of the mandibles is a 6-jointed palp, shaped like the legs, which, besides other uses, serves to hold and turn the prey when swathing it or feeding upon it. The eight legs are attached to the cephalothorax, are 7-jointed, covered with spines, bristles and hairs, the tarsal joint ending in a foot having two or three claws constructed for grasping and handling delicate threads. The second main part of the spider's body is the abdomen, which while generally ovate greatly varies in form; being globular, subtriangular, cylindrical; sometimes flat, sometimes convex above. The ventral surface is flat or slightly converse. The integument is commonly soft, but sometimes leathery; in many species it is

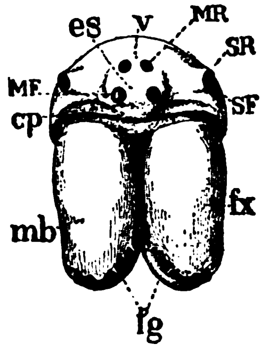


Ventral view of *Argiope argyraspis*. ps, palps; mx, maxilla; ax, cu, hu, ra, dg, the axillary, cubital, humeral, radial, digital joints of palpi; sm, sternum; cx, coxa of the leg; gl, breathing gills; ep, epyginum; sp, spinnerets, shown closed; ac, anal closure.

hairy; in others nearly naked and glossy; in some bordered with sharp, hard, spinous processes or conical tubercles at the base, which for the most part overhangs the cephalothorax. The pedicle or stem uniting these two principal parts of the body is a short cartilaginous tube through which pass the organs of nutrition and circulation. This partial description, with the accompanying figures, will give a sufficient general idea of the structure and appearance of the most common species.

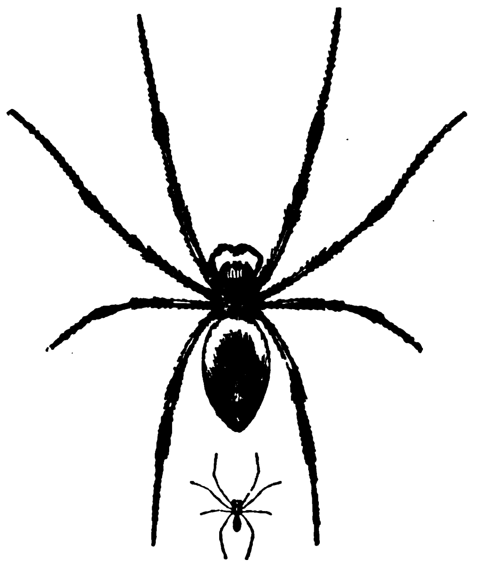
The mature male is most readily distinguished from the female by the bulbous shape of the terminal joints of the palps, which often assume involved forms that serve as good specific characters. Sometimes, as in certain orbweavers, the male is so much smaller than his mate that the disparity seems ridiculous. Wooing under such conditions is a serious undertaking. One will see several diminutive courtiers in attendance at the outer courts of the snare of our native species, the orange and the silvery Argiope (*A. aurantium, A. argyraspis*); and not infrequently dead and juiceless skeletons may be seen hung up thereto in silken swathments, like scalps upon a savage's wigwam.

Habits.— Gravid females differ largely in their modes of caring for their eggs and young. Most species enclose the eggs in a silken sac,



Face of *Epeira* mb, mandibles, with the falx, fx, and fangs, fg; es, eye space; v, vertex; cp, clypeus; MR, mid-rear eyes; SR, side-rear; MF, mid-front; SF, side-front.

which is protected in various ways. Orange Argiope spins a large pryiform cocoon with a tough, nearly waterproof case, lined inside with yellow floss, which encloses an ovate mass of brown silk, within which are the eggs numbering as high as a thousand or more. This is hung upon bushes, stayed and surrounded by sundry braces and cross-lines. The labyrinth spider (*Epeira labyrinthea*) puts her eggs into several silken disks strung together in a bead-like row, which is swung within the thick maze that surrounds the leaf-thatched domicile that overhangs her orb. Many orbweavers spin their cocoons in angles of cornices, under bark, in cracks and crevices, knot-holes and sheltered

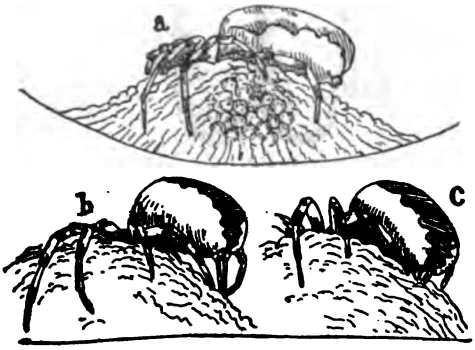


Female (upper figure) and male (lower figure) of *Nephila nigra*, shown one-half natural size.

openings of all sorts. A bit of loose bark on an old tree is a favorite cocooning place for many spiders; there the speckled tubeweaver will often deposit her eggs within several wraps of silk, all overlaid with bark pellets gnawed from

Digitized by Google

the tree. Some of our familiar lineweavers, as *Theridium tepidariorum*, put their eggs into several brown sacs which they keep near them within their netted cobwebs, on which the spiderlings hang when they are hatched. Many tubeweavers and laterigrades spin a tough disk, white, gray, mottled or pinkish, against various surfaces, especially on or under stones. Most species die shortly after cocooning, and the young are left to the nurture of nature. Others



(a) *Epeira strix* spinning her egg-cocoon. (b) The inner covering of the egg-mass. (c) Overlaying the thick outer covering.

have some sort of care over the spiderlings when they appear, and until they leave the home bounds. Among ground-spiders (*Lycosidæ*) one notes the interesting habit of tying the round egg-bag to the spinnerets and carrying it around until the younglings come out, when they mount the mother's back and are borne around clinging thereto until they disperse. A mother with a hundred babies piled upon her body as she runs over the ground is a grotesque spectacle; but the oddity vanishes in the light of mother-love. At least one species, the European water-spider, cocoons under water within her diving-bell-like domicile. This is but a glance at the varied forms which maternal instinct takes among spiders to perpetuate the race.

Beneficial Uses.— One needs to give good heed who would know how large a part spiders have in the economy of nature. They are among the most numerous of our fellow tenants of the earth. A fair idea of the myriads that live near us may be had on a dewy morning of late summer or early autumn. Glancing over the fields and along the country roadsides one will see their webs, disclosed by the minute beads of mist caught by the delicate threads, literally covering the low herbage. Turning the eyes to bushes and trees, the branches, twigs and leaves are seen to be meshed with spinning work. In short, the whole landscape is overspread with the tents and meshes of the aranean hosts. Other hosts could be found by raking amid fallen leaves and earth-litter, and searching beneath stones, logs and rubbish, in hollow trees, post-holes and crannies, under ledges and along the water side. There is scarcely a spot, indeed, where some species of spider may not be found. The problem of commissary supplies for this innumerable army is an important one; and its consideration opens up a strange contradictory phase of human nature, or perhaps one should say of human ignorance.

The popular prejudice against spiders has been so long fixed that it is hard to overcome it, but is yielding before the better knowledge of natural objects and sympathy therewith that now prevail. The prejudice is perhaps largely due to erroneous views of their ugliness and dangerousness. The species frequenting cellars and outhouses are dark colored and at first glance somewhat ungainly. But to judge the race by these would lead one as far astray as to judge all birds by buzzards and crows. In truth, some spider species rival butterflies and beetles in brilliancy of color. And these are not tropical forms alone, but are among our indigenous species, and may be found in most parts of America by searching fields, bushes, bosky brook-sides, the edges of woods and open places therein. Delicate greens, pink, ruby, scarlet, orange, yellow, brown, gray, and metallic hues, silver and green especially, abound, and give remarkable beauty to the outer robing of our native fauna. Exotic species are even more brilliant.

Yet more erroneous is the popular view of the spider's noxious and injurious character. That a few species may and occasionally do inflict a wound that may cause suffering and under peculiar conditions even death, is doubtless true; although it is nearly impossible to verify current reports of injury and death caused by a so-called "black spider," which, as it commonly turns out, had simply been seen somewhere near the victim. That insects inflict wounds which may be serious under certain unfavorable conditions, is well known; and the possibilities for great damage to the human family by flies and mosquitoes is now established. But spiders may be ranked among the least dangerous to man of the small and most familiar invertebrates. The writer has been struck by large lycosids (ground-spiders), and has compelled one of our largest orbweavers to wound him, without more serious consequences than the prick of a pin. A mosquito's puncture, on the contrary, causes a pain-

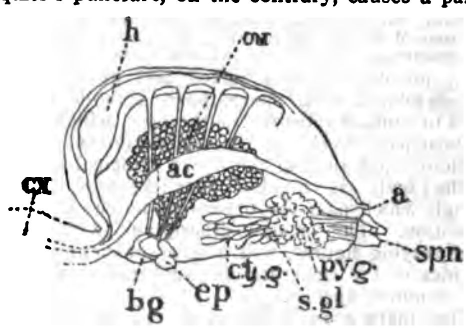


Diagram showing location of spinning organs in the abdomen of an orbweaving spider. spn, spinnerets; s. gl, silk glands; py. g, pyriform; cy. g, cylindriform, and others which connect by delicate ducts with the outer spinning-spools; cx, cephalothorax; h, heart; ov, ovaries; ac, alimentary canal and its termination, a; bg, breathing gills; ep, epigynum and oviduct.

ful hurt, with an inflamed area the bigness of a silver dollar surrounding the central white swelling. This will show that personal idiosyncrasies are factors in the danger to man of a spider wound, as of an insect's. Admitting the worst, however, the credit side of the spider account is so large that the reverse is scarcely

Digitized by Google

worth mention. Insects are known to be serviceable in the fertilization of many plants. The bee has been domesticated for the edible product of her cells, and the silkworm for its cocoon fibre. But beyond these and a few other exceptions, the insect hordes are among our most destructive domestic foes. Farm, garden, orchard and plantation can be profitable only by vigilant and unremitting warfare upon these destroyers

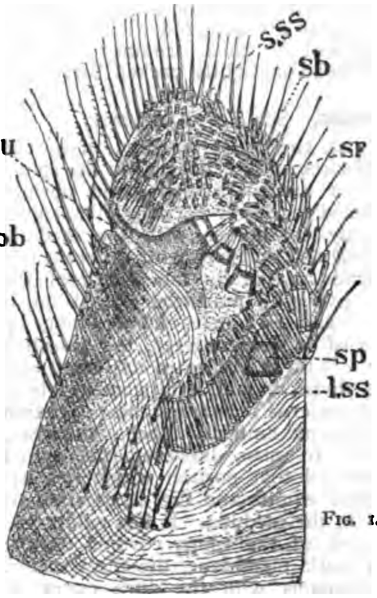


FIG. 1.

FIG. 1.—A posterior spinneret of *Epeira*. Sp, spigot-spool; l. ss, long spinning spools; s. ss, short spools; bb, branched bristles; sb, simple bristles which aid in spinning.
FIG. 2.—A middle spinneret of *Epeira*, sp. c, spigot spool discharging cylindrical gland; ss and s. ss, spools of pyriform gland; sp. t, of treeform gland.

whose inroads cost the nation hundreds of millions yearly. But spiders injure no food-plant or other product of human industry. In fields and groves, orchards and outhouses they are not only absolutely innocuous, but are engaged in ceaseless warfare upon the enemies of man's prosperity, comfort and health. Their chief food is insects; and day and night they pursue that function which nature has assigned them, and keep in check the myriads of insects that otherwise would overwhelm us. It is doubtful if civilized man could successfully cultivate or even inhabit the earth, if it were not for these despised benefactors, unless nature were to provide some other agency to hold even the balance of helpful and harmful life. Even when spiders enter our homes, and spin their cobwebs in our porches, halls and chambers, they come upon the wholesome errand of clearing our premises of irritating and dangerous guests. It is pitiful that these benefactors of our race should be the subjects of unsparing obloquy and hate, and should be slain at sight without compunction.

Bibliography.— The literature of spiders is too abundant to be here cited; but from several American works the student may obtain needed help. Among them are: 'Spiders of the United States' by Prof. Hentz, the father of American araneology; Dr. McCook's 'American Spiders and their Spinningwork,' 3 vols. folio, profusely illustrates structure and habits and gives classification of Orbweavers; the studies by Prof. Geo. W. and Mrs. Elizabeth G. Peckham of general habits are most interesting, and their work on the 'Attidæ' is quite complete; 'The Common Spiders of the United States' by J. H. Emerton, is a good popular treatise; 'Catalogue of the Described Araneæ of Temperate North America' by the late Dr. George Marx of the Smithsonian Institution, is valuable; Nathan Banks of the National Museum, Washington, has written some important papers, as also has Prof. Thos. Montgomery of the University of Texas, Austin. Among foreign works one should know the 'Histoire Naturelle des Araignees' of M. Eugene Simon. Among British authorities consult 'Blackwell's Spiders of Great Britain and Ireland,' and the works of Dr. Pickard.

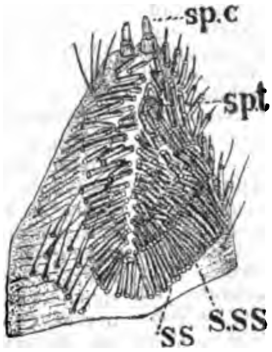


FIG. 2.

HENRY C. MCCOOK,
Author 'American Spiders and Their Spinning Work.'

Spiderwort, any plant of the genus *Tradescantia*, or (by extension) of the family *Commelinaceæ*. The spiderworts are perennial, succulent, somewhat mucilaginous herbs, having linear or lanceolate leaves and showy reddish or blue flowers in umbel-like cymes, subtended by bracts. *Tradescantia virginiana* is a species native to the Middle Atlantic States, but often found farther north in cultivation or escaped from gardens. It has stems often in clusters, and about a foot high; the leaves very narrow, either glabrous or slightly pubescent, as long as the stem and of a bright green color. The large corollas of three petals are sky-blue, the villous pedicels being declined until in bloom. The sepals are broad and herbaceous. The anthers are large, crescent-shaped, and golden, and the filaments are heavily bearded. A South American spiderwort, *T. fluminensis*, is better known under the title of Wandering Jew. It has similar flowers and broadly lanceolate leaves, and is very easily propagated by cuttings, growing often in water only.

Spiegeleisen, spē'g'l-ī"zĕn, a peculiar kind of cast iron made from specular iron ore, or hematite, containing a large percentage of carbon and manganese. Being remarkably free from impurities, as phosphorus, sulphur, silica, it is largely used in the Bessemer process of steel-making for the purpose of re-introducing carbon.

Spielhagen, spēl'hä"gĕn, **Friedrich**, German author: b. Magdeburg 24 Feb. 1829. He studied at Berlin, Bonn, and Greifswald, turned from an academic career to literature, made some translations from French and English, including one of 'Amerikanische Gedichte' (1856; 3d ed. 1871), and after publishing two sketches that attracted little attention, became well known through his 'Problematische Naturen' (1860), in which he advocated the advanced liberal politics of his time. His 'Sturmflut' (1876), based on the financial crises in Berlin following the Franco-Prussian war, is worthy of comparison with this. His other works are generally inferior, and later critics object to his obsolete

Digitized by Google

methods, as in 'Faustulus' (1897). His books are often truly voluminous, and frequently somewhat grandiose, but display a certain energy of treatment in dealing with what the author believed important questions of the time.

Spiers, spērz, **Richard Phené,** English architect and archæologist. He was educated at King's College, London, and the Ecole des Beaux Arts, Paris, and is master of the Architectural School and surveyor of the Royal Academy. In addition to editing Pugin's 'Normandy' (1870) and Fergusson's 'History of Architecture' (1863), he has written 'Architectural Drawing' (1887); 'The Orders of Architecture' (1902); 'Architectural Essays on Sassanian Architecture'; 'Domed Churches in Perigord'; 'Architecture, East and West.'

Spigelia, spī-jē'lĭ-a, a genus of annual and perennial herbs of the order *Loganiaceæ*, of which about 35 species are American. They have opposite, membranous leaves and terminal spikes of yellow, red, or purplish flowers. The best known one, pink-root or worm-grass (*S. marilandica*), is native from New Jersey to Wisconsin and southward to the Gulf States. It is valued in hardy garden borders because of its handsome, red, tubular, yellow-throated flowers which appear during mid-summer, and also because of its easy culture in rich, friable, loamy soils. Its roots have been used medicinally.

Spike'nard, a North American herb. See Aralia.

Spina Bifida, cleft spine. See Tumor.

Spinach, spĭn'āj, or **Spinage,** an annual herb (*Spinacia oleracea*) of the order *Chenopodiaceæ*. The plant is probably indigenous to southwestern Asia, whence it has been carried to all cool climates throughout the civilized world for use as a potherb. The original species has a rosette of arrow-shaped radical leaves, from the centre of which a flower-stalk is developed 2 to 3 feet tall, and bearing small axillary clusters of diœcious flowers followed by seed-like fruits (akenes). In cultivated varieties the form of the leaf is various, and its size and thickness greater than in the wild. Only one other species of the genus is now recognized (*S. tetrandra*) but is not cultivated. There are, however, groups of varieties which have been given specific names mainly because of the form of the fruits — the prickly-seeded (*S. spinosa*) and the round-seeded (*S. oleracea*). Though the popular names are retained in the trade the plants are considered one species. The original form is not known. Spinach delights in light, well drained, loamy soils, and always gives best returns when abundant nitrogenous food is readily available. It is easy of cultivation. The seed may be sown in early autumn, and in the North covered during the winter with loose straw or marsh hay, free from weed-seeds. In spring the mulch should be removed very early. Early spring sowing may be done but, since the plants produce smaller, fewer, and poorer leaves, and are prone to develop a seed-stalk at the approach of warm weather, the planting season in spring must be curtailed. About eight weeks usually elapse between sowing and gathering the plants except when the crop is wintered. In field practice spinach is usually sown in beds about 10 feet wide made by plowing several furrows toward a centre and leaving dead furrows between the beds for surface drainage. The seeds are sown in drills about 15 inches apart and the ground kept cleanly cultivated. Since the crop is of short duration it is generally used prior to or after summer-maturing crops. It is, however, also frequently sown between the rows of other crops. Immense quantities of spinach are grown in the South, especially upon the Atlantic seaboard for the northern markets, and except for home-use the cultivation of the crop under cold frames is now little practised in the North. The plants are gathered when dry with some of the root attached, trimmed of dead leaves and shipped in tightly packed barrels or crates.

Spinal Caries. See Pott's Disease.

Spinal Cord, the posterior portion of the cerebro-spinal axis, entirely located in the spinal canal. In those animals which stand upright it may be termed the lower portion. The spinal cord is directly continuous with the medulla oblongata (q.v.) and, varying with different animals, it extends practically the length of the spinal canal, giving off numerous paired spinal nerves (q.v.), and terminates by breaking up into a series of terminal nerves, the so-called cauda equina. With reference to its length and thickness, its divisions, and arrangements, both internal and external, considerable variation exists in different animals. (See Anatomy, Comparative.) In man, however, the spinal cord comprises all that portion which lies between the cauda equina and the decussation of the pyramids in the medulla. It lies within the bony framework of the spine, covered on the outside by a thick membrane, the dura mater, which is continuous with the dura mater of the brain. Within this is a thin delicate layer of tissue, the pia mater, which covers the cord closely, being continuous with the pia mater of the brain. Between the dura and pia a certain amount of cerebro-spinal fluid is found, which serves as a protection-sheath. Passing out and coming into the cord are the paired motor and sensory nerves that carry motor impulses to all the muscles of the body below the head, and sensory impulses to the brain from all the sense organs of the skin, mucous membranes, and viscera. The general shape of the spinal cord is cylindrical. It is slightly flattened front and back, and tapers at its caudal end into a long thin strip, the filum terminale. In its course it shows two enlargements, the cervical and dorsal enlargements, corresponding to the location of increased amounts of nervous tissue that go and come from the upper and lower extremities. The length of the cord proper, apart from its terminal filament, averages only about 18 inches, it therefore falls short several inches of filling the entire spinal canal. It is about ½ inch in width at the widest part, and weighs in an average adult about one ounce. The spinal cord is nothing but a collection of nerve ganglia and nerve-fibres, but in the human cord these are not as simple in their arrangement as in the nervous cords of insects, for instance. The cord preserves its bilateral symmetry, but its metameric symmetry is much modified, particularly in its internal structure. Thus the spinal cord consists of nerve-cells and nerve-fibres like all other parts of the nervous system. It is divided almost into two halves by deep fissures in front and behind; and there

Digitized by Google

are several secondary fissures that further subdivide the cord into segments corresponding somewhat to its anatomical arrangement. In order to understand somewhat of this anatomical arrangement it is important first to trace the different fibre-tracts that go up and down the spinal cord, and which make up its white matter. The first nerve-fibres to develop are sensory. These collect into bundles and, through the posterior spinous processes, pass into the cord and constitute two bundles of fibres, the columns of Gall and the columns of Burdach. These columns are at first very small, but as they continue to receive more and more fibres passing upward they become larger. After their entrance into the cord the sensory fibres give off many collaterals, making extremely complicated anatomical connections with the different segments of the cord. One set of these collaterals, however, makes a distinct bundle of fibres, which has been called the column of Gowers, or ascending lateral tract. All three of these fibre-tracts carry sensory impressions from the surface to the brain; they constitute the sensory neuron-paths. The column of Gowers is known to carry pain-sensory stimuli. These sensory neuron-paths terminate in the sensory areas (q.v.) in the brain, having numerous interruptions or stations, as it were. The typical sensory neuron-path is made up of three of these stations. The first ganglionic centre is in the end-organ; the second is in the medulla, constituting the nuclei of the columns of Gall and Burdach; and the third is in the cortex. Numerous variations from this type are known. Passing down from the brain a large number of motor tracts make up the larger part of the remaining white matter of the cord. The most important of these bundles are the direct and indirect or crossed pyramidal tracts. The descending anterolateral tract and direct cerebellar tract are other smaller fibre-masses. Still other minute fibre-bundles are found in the cord, but their description belongs to more extensive treatises. The main function of these descending tracts is to carry motor impulses down from the motor area to the gray masses of nuclei located on the interior of the spinal cord. From these spinal centres the impulses are transmitted to the motor nerves which pass out the entire length of the cord, from in front, where they later bend backward and join the sensory fibres and together form mixed nerve-trunks. The motor nerves finally terminate in the muscles by specially modified muscle-plates. As the nuclei of the columns of Gall and Burdach in the medulla were the first ganglionic terminals of the sensory neuron-chains, so the gray masses in the cord are the first ganglionic terminals of the motor neuron-chain. If the spinal cord be cut across, these ganglionic masses appear on the cut surface as a gray letter H, or as a butterfly-wing, according to the region where the cut is made. In these wings certain definite groups of ganglion-cells may be made out, running short distances up and down the spine. These constitute definite ganglionic centres for certain muscle-groups, and their destruction causes the well-known spinal paralysis of children. Throughout the entire length of the spinal cord there is a small cavity around which there are bridges of fibres connecting the two halves of the cord. Thus the spinal cord is seen to represent a mass of cells and fibres, of vastly complicated structure, and subserving all of the nervous functions of the muscles of the skeleton and of the viscera below the diaphragm, save the stomach. The spinal cord is in intimate connection throughout its entire length with the sympathetic nervous system. Consult: Barker, 'Nervous System' (1901); Dejerine, 'Anatomie du Systeme Nerveux' (1901–4); Van Gehüchten, 'Systeme Nerveux' (1903); Spalteholz, 'Anatomy Atlas' (1904). See Brain; Nervous System; Reflex Action; Sympathetic Nervous System.

Smith Ely Jelliffe, M.D.,
Editor 'Journal of Nervous and Mental Disease.'

Spinal Nerves, the paired nerves which arise from and pass into the spinal cord (q.v.), and which are distributed to the various muscles of the body, and come from the various sense-organs, skin, intestines, bladder, etc. The spinal nerves are so named in contradistinction to the cranial nerves, or those which originate from or pass into the brain itself. From the spinal cord of man 31 pairs of spinal nerves arise. They pass from and enter into the spinal cord and spine through the intervertebral foramina, or openings between the bodies of the vertebræ, the motor part of the nerve passing out in front, the sensory part coming in from behind. Eight pairs are cervical; 12 are dorsal nerves, also named thoracic; 5 are lumbar, 5 sacral, and 1 coccygeal. Each spinal nerve is formed from two portions, an anterior or motor, and a posterior or sensory. The posterior root has a nerve-mass or ganglion, which is wanting in the anterior. The fibres of the anterior roots are motor in nature; that is to say, impulses travel by these roots outward from the cord or brain to the body. The fibres of the posterior roots are sensory: impulses are conveyed by these fibres to the cord or brain. The anterior and posterior fibres unite just beyond the nervous ganglion to form a single nerve-trunk, in which the two sets of fibres are indistinguishable. See Anatomy; Brain; Nervous System; Spinal Cord.

Spindle-tree, a name originally applied to a European species of *Euonymus*, shrubs belonging to the *Celastraceæ*. The American species have more or less four-angled and winged stems, with petioled entire or serrate leaves, and regular, perfect 4 to 5-merous flowers in axillary cymes. They open in early summer, and are small and inconspicuous, and greenish or purplish in color; they are succeeded, however, by very brilliant fruits or pods, which are several-celled, lobed, or angled, and which, when mature, open, showing the somewhat fleshy red arils which have grown up from the base of the seeds, and now enclose them. The fruits remain on the tree during the winter, so that these shrubs are often cultivated in ornamental shrubbery. *E. europæus* is called spindle-tree, because its hard, close-grained, white wood was once esteemed as a material for spindles, musical instruments, and netting needles, and is still used for skewers and in turning. It is a glabrous shrub, with broad and shining leaves, and deeply four-lobed, smooth pods which have been employed as a dye-stuff. One of our most handsome shrubs in autumn is the burning bush, or

Digitized by Google

wahoo, *E. atropurpureus*, with crimson and scarlet lobed capsules. *E. americanus* is the strawberry-tree, a low bush, with oval leaves, and a crimson capsule, scarcely lobed, but covered with pointed warts, and disclosing scarlet arils. The *E. obovatus* is similar in fruit, but has a trailing habit and obovate leaves. The foliage of a Japanese species (*E. alata*) turns to a brilliant rose pink in autumn.

Spine, the backbone of a vertebrated animal. See ANATOMY; OSTEOLOGY; POTTS' DISEASE; SPINE, PATHOLOGICAL CHANGES IN; TUBERCULOSIS.

Spine, Pathological Changes in. The odontoid process of the axis of the spine presents two articulating surfaces, one in front, of an oval form, for articulating with the atlas, and another for the transverse ligament, the latter frequently encroaching on the sides of the process. Displacement at this point of articulation causes instant death, due to pressure and injury of the cord and nerve-trunks. The vertebral column quite frequently sustains fracture from an indirect violence which tends to produce overexertion on one flexion of its normal curvatures. Tuberculosis of the vertebral articulations or Pott's disease is an affection of the spine.

At birth there are no curves in the infant's spine, but as the child assumes the sitting or erect posture, curves which are recognized as the normal vertebral curves, are developed. Weak muscles, careless postures, and paralysis of special groups of spinal muscles are causes of spinal curvature. Scoliosis is lateral curvature, that is, with the convexity of the curve to one side. Cyphosis, or humpback, is the form in which the convexity of the column is increased in a posterior direction. Lordosis, or hollow-back, is a spinal deviation in which the convexity of the curve is forward; it is usually found in the lumbar region, due to an aggravation of the normal lumbar curve. Inflammation of the cord rarely gives rise to pus, but a few cases have been described. The suppuration is necessarily micro-organismal in origin, and as a rule it is either due to some septicæmia or traumatism, or secondary to purulent meningitis. The spinal cord (q.v.) is influenced by diseased conditions of other parts of the body. It is the centre for all the degenerative disorders of the nervous system, such as locomotor ataxia, degenerative spastic paraplegia, primary lateral sclerosis, etc.

Spine-foot, a genus of lizards (*Acanthodactylus*), so named from the spinous appearance of the toes, which are «keeled» beneath, and possess fringed edges. A familiar brown species (*A. vulgaris*) occurs from Spain and Morocco eastward to northern India.

Spin'el, an isometric mineral of many colors, almost always in octahedral or dodecahedral crystals. Octahedral twins are so common as to give the name «spinel twin» to this form (see explanation under MINERALOGY). It is characterized by a hardness of 8, which is exceeded by only three minerals, diamond, corundum, and chrysoberyl, and is equaled by but a few. It is brittle; fracture conchoidal; specific gravity, 3.5 to 4.1; lustre vitreous; streak white; transparent to nearly opaque. Essentially it is a magnesium aluminate, or a compound of the oxides of magnesium and aluminum, these metals being at times in part replaced by iron, and, in the variety picotite, also by chromium. The varieties are distinguished by differences both in color and composition. The red variety is often transparent, and is known as ruby spinel (q.v.) or balas ruby. Rubicelle is yellow or orange-red; ceylonite or pleonaste is dark-green, brown, or black, and nearly opaque; chlorospinel is grass-green. Blue and yellow varieties are also found and sometimes yield choice gems. Its most noteworthy occurrences are in the gem gravels of Ceylon, Burma, and Siam, in the ejected blocks of Vesuvius and in the limestone belt of Orange County, New York, and Sussex County, New Jersey.

Spinel Group, an important group of isometric minerals, usually included among the oxides, though chemically they are oxygen salts. The group embraces the closely related aluminates, spinel, hercynite, and gahnite; the ferrates and manganates, magnetite, magnesioferrite, franklinite, and jacobsite; and the metachromite, chromite. Their general formula is $R''R'''_2O_4$.

Spinello, spē-nĕl'lō, **Di Luca** (called SPINELLO, ARETINO), Italian painter: b. Arezzo 1333; d. there 1410. His principal frescoes were done for the sacristy of the church of Saint Miniatus near Florence, for buildings at Pisa, Siena, Arezzo, and for the municipal buildings of Siena (a series illustrating the Italian wars of Frederick Barbarossa). Spinello enjoyed a great reputation in his own day, being compared and by some preferred, to Giotto, whose style his own in some respects resembles. His ‹Virgin and Child› sold in 1889 for $3,725.

Spin'et, a stringed instrument formerly much in use, but now superseded by the pianoforte. It was somewhat similar to the harpsichord, and like that consisted of a case, sounding-board, keys, jacks, and a bridge. The difference between the spinet and the harpsichord was, that the latter was larger, and contained two or three sets of jacks (small oblong slips of wood, with crow-quills attached for striking) and strings so disposed and tuned as to admit of a variety of stops, while the former had only one set of jacks and strings, and consequently only one stop. See PIANOFORTE.

Spin'garn, Joel Elias, American educator: b. New York 17 May 1875. He was graduated from Columbia University in 1895, and was assistant professor of literature there 1899–1900. He is a member of the Société d'Etudes Italiennes, Paris, and published ‹A History of Literary Criticism in the Renaissance› (1899).

Spin'ifex, or Porcupine Grass, a perennial grass (*Triodia irritans*) which grows on otherwise barren dry ground in Australia, forming tussocks through which horses and men find difficulty in progressing because of the uncertain footing and because the spiny edges of the hard leaves cut the clothing or feet.

Spinner, spĭn'ĕr, **Alice.** See FRASER, AUGUSTA ZELIA WEBB.

Spinner, Francis Elias, American financier: b. German Flats (now Mohawk), N. Y., 21 Jan. 1802; d. Jacksonville, Fla., 31 Dec. 1890. He was apprenticed to a confectioner, and then to a saddler, but in 1824 became a merchant at Herkimer, N. Y. He was deputy sheriff of Herkimer County in 1829–34, sheriff in 1835–7, was active in the militia where he gained the rank

Digitized by Google

of major-general, and in 1838–9 was State commissioner for building the State lunatic asylum at Utica. He was connected with a bank in Mohawk for 20 years as cashier and as president, was auditor and deputy naval officer in the naval office at New York in 1845–9, and in 1855–7 was a Democratic member of Congress. He was one of the original members of the Republican party, was re-elected by it to Congress in 1856 and in 1858, and was appointed United States treasurer by President Lincoln in 1861, a post which he occupied until 1875. He was the first to suggest the employment of women in the government offices and carried his point, though against much opposition. His name became during his long term of office the synonym of integrity, and his designedly singular signature on the "greenbacks" of the United States was the most familiar autograph in the country.

Spinning, the process of reducing to fine threads of uniform size, fibres of cotton, flax, or wool for weaving purposes. The process was performed by hand from early Egyptian times with the distaff and spindle, the distaff being a stick or staff on which a mass of carded or prepared raw material called a roving was loosely bound, and the spindle being a smaller round stick to which the thread was attached, and around which it was spun by adroit manipulation.

The spinning wheel to revolve the spindle, attached to its frame, was an improvement on the manual method, introduced from India into Europe during the 14th century, and thence to America in the 17th century. Its use did not begin to be displaced until the middle of the 18th century, and it was still to be seen in operation at the beginning of the last quarter of the 19th century, in many provincial places untouched by railways, throughout Europe and other parts of the world. The operation usually performed by young women gave rise among English-speaking people to the word 'spinster.'

Hargreaves's spinning jenny, an improvement on the double-thread producing Saxon wheel, invented in Nuremberg about 1530, Arkwright's throstle machine, or roll-drawing spinning machine, and Crompton's mule-spinner, three inventions of the latter half of the 18th century, revolutionized the art of spinning, and although many important improvements have been made since in constructive details, the general principles of all modern spinning machinery are those of these three inventions.

The spinning jenny invented by James Hargreaves in 1767, in its simplest form, resembled a number of spindles turned by a common wheel or cylinder which was worked by hand. It stretched out the threads as in common spinning of carded cotton, eight at a time. but this was soon improved upon until 80 could be spun as easily.

The throstle or roll-drawing spinning machine, patented by Arkwright in 1769, had for its object the drawing of the rovings through successive pairs of rollers, each pair in advance of the others and moving at different rates of speed. The first pair to receive the sliver compressed it and passed it to the second pair, which revolved at a greater speed, and thus pulled it out to exactly the number of times greater length that their revolutions exceeded those of the other pair. As the roving issued through the last rollers of each machine, it was received on spools or reels, calculated to hold a given quantity; and these were transferred to the spinning-frames, which resembled the roving frames. As the roving unwound from the spool, it was drawn through successive pairs of rollers, moving as before at different rates, each succeeding pair faster than the backward ones, so that the roving got thinner and thinner, until the tenuity was carried as far as desirable. It was then carried on to a spindle which revolved with great rapidity, and by a simple arrangement was made both to twist the thread and to wind it on the spindle ready for the weaver.

As Arkwright's machine produced too great a strain on the thread in its progress to admit of it being drawn sufficiently fine as wanted for many purposes, Crompton in 1779 invented the mule jenny, which had a travelling frame upon which the spindles were set, and which combining the principles of the two preceding inventions, produced much finer yarn. This frame is now made long enough to carry hundreds of spindles, and it gently draws out and twists the thread after it leaves the last pair of rollers; when it has reached its limits, now several yards, but in Crompton's time only five feet, it rapidly returns, winding up the spun thread on the spindles as it goes back.

The preparation of fibres for spinning involves various important processes upon which the quality of the yarn produced, depends. These include: the opening of the fibres to relieve them from knots and lumps, a strong blast of air also being driven through to carry away dust and foreign matter; the beating and rolling into laps, which involve much careful attention, as on this first operation the ultimate size of the yarn depends; and the carding or combing of the laps into a narrow web, which passing through calender rollers coils in the form of a loose untwisted column of cotton or wool, about an inch in thickness, called a sliver.

The most modern machines combine in one the operations of carding, roving, and spinning, and these machines are now applied with various necessary modifications to cotton, wool, flax, silk, and other textile materials. See WEAVING COTTON MANUFACTURES: WOOLEN MANUFACTURES.

Spinning Fibres. See FIBRES.

Spinning Jenny, in textile manufacture, the name given by James Hargreaves to the spinning machine invented by him in 1767. The name jenny is a corruption of engine, the term gin being a common local expression for a machine. It consisted of a number of spindles turned by a common wheel or cylinder worked by hand.

Spinola, spē'nō-lä, **Ambrosio,** MARQUIS OF, Italian general: b. Genoa about 1570; d. Castelnuova 25 Sept. 1630. In 1602 he joined the Spanish forces in the Low Countries, with 9,000 Italian and Spanish veterans, whom he raised, equipped, and maintained at his own cost. As a consequence while mutiny and insubordination prevailed in the rest of the army, his 9,000 Walloons were models of discipline and order. The Archduke Albert of Austria, then governor of the Netherlands, employed Spinola in the cap-

Digitized by Google

ture of Ostend, long besieged by the Spanish troops. It fell into his hands in September 1604, after having sustained a siege of three years and two months. Spinola then hastened to Madrid, to give Philip III. information of the discontent and insubordination that were rife among the greater part of the troops in the Netherlands, and was named commander-in-chief of all the Spanish and Italian forces in the Netherlands. On returning he found Maurice of Nassau opposed to him, and in him met a more formidable opponent than he had hitherto encountered. A decisive naval action near Gibraltar, in which the whole Spanish fleet was destroyed by the Dutch admiral Heemskerk (1607), induced the Spanish court to propose an armistice, which was concluded between Spinola and Maurice for 12 years (1609). Spinola was actively engaged during the Thirty Years' war; and in 1620 he conquered the Lower Palatinate, which had fallen into the hands of the Protestant League. In 1621, the truce with Holland having terminated, he took Juliers, after which he invaded Holland itself, and laid siege to Bergen-op-Zoom; but while besieging this place he found himself unexpectedly attacked at once by Mansfeld and Maurice, and was obliged to raise the siege. In 1624 he invested Breda, the gates of which were opened to him after a 10 months' siege (May 1625). This was his last achievement.

Spinoza (Spĕ-nō'za) **Baruch** or (in the Latinized form later adopted) **Benedictus**, Dutch philosopher: b. Amsterdam 24 Nov. 1632; d. The Hague 21 Feb. 1677. His parents belonged to a community of Jewish emigrants from Spain and Portugal who had been driven out of these countries by religious persecution and settled in Amsterdam. There the Jews soon took an important place in the commercial life of the city, though maintaining their own language, religion, and distinct social life. Spinoza was carefully educated by the rabbis of his own people in Hebrew theology and literature, including, of course, the Talmud, and also the more modern commentaries of Maimonides (q.v.) and Ibn Ezra. He was also sent to the Latin school of Van den Ende, an Amsterdam physician, where he received his first impulse to the study of Descartes' philosophy and his first lessons in the principles of natural science. After he grew to manhood, suspicions of his orthodoxy were raised, and after several attempts to induce him to conform to the faith of the synagogue had failed, he was expelled from the Jewish community in 1656. Henceforth he provided for himself a slender but sufficient income by grinding and polishing lenses for optical instruments, while devoting the remainder of his time to the development of his own philosophical ideas. He lived first in the country near Amsterdam, at Rijnsburg near Leyden, then at Voorburg, a suburb of The Hague, and from 1670 to the end of his life in The Hague itself. Secluded as was his life, he was recognized both as a skilful optician and as an original philosophical thinker. He communicated his ideas to a club of young men at Amsterdam,— the short tractate entitled 'De Deo et homine ejusque fecilitate,' which was discovered in manuscript form in 1852, being probably written for this purpose. Spinoza also maintained relations with the literary and scientific circle at The Hague, and corresponded with some of the noted scientific men of his time. He was also a personal friend of John De Witt (q.v.) and is said to have been consulted by him on affairs of state. In 1673 he refused a chair of philosophy which had been offered him in the University of Heidelberg, feeling that it would be impossible to obtain in this position complete freedom for the expression of his views. He maintained his independence to the last, living in humble circumstances and devoting himself to the life of thought which he had chosen. He died in his 44th year.

Spinoza's first work was an application of the geometrical method to the first two parts of Descartes 'Principles,'—'Renati DesCartes Principiorum philosophiæ, Pars I et II more geometrico demonstratæ' (1661). In 1670 appeared his 'Tractatus Theologico-Politicus,' which is described on the title page as «containing some discussions to show that the liberty of philosophizing may be allowed without any danger to piety or the safety of the State; but that the loss of the public peace and even of piety follows when this is taken away.» The main thesis of the work is that «in a free commonwealth it should be lawful for every man to think what he will and to speak what he thinks.» To support this he undertakes an investigation of the principles of scriptural interpretation and the relation of theology and philosophy, «anticipating,» as Sir Frederick Pollock has remarked, «with wonderful grasp and insight, almost every principle and not a few of the results of the school of historical criticism which has arisen within the last two or three generations.» This work aroused so much opposition in theological circles that Spinoza did not think it wise to publish the 'Ethics,' his chief work, on its completion in 1675. This appeared in the year of his death in the 'Opera Posthuma,' which also contained the 'Political Tractate' and the 'Tractate on the Improvement of the Understanding,' both unfinished, as well as a compendium of Hebrew grammar, and selections from the correspondence.

Spinoza's philosophy, notwithstanding its severe scientific form, is based on ethical motives, and has a decidedly practical character. What he sought through his life of lonely meditation was not knowledge as the satisfaction of mere intellectual curiosity, but rather knowledge of man's place in the universe as practical insight into the nature of his true and permanent good. In the 'Improvement of the Understanding' we find an autobiographical account of Spinoza's decision to choose the highest end of life. After explaining the unsatisfactory nature of a life devoted to pleasure or honor or riches, and the evils and disturbances to which such a life is subject, he says: «All of these arise from the love of what is perishable, such as the objects already mentioned. But love toward a thing eternal and infinite feeds the mind wholly with joy and is itself unmingled with any sadness. Wherefore it is greatly to be desired and sought for with all our strength.» Moreover, «whatsoever in the sciences does not serve to promote our object will have to be rejected as useless.» Nevertheless, there is for Spinoza no opposition between theory and practice; for the knowledge of the

Digitized by Google

systematic unity of all things, and of God as their source and essence, is itself the supreme good and blessedness for man. The highest good is realized only in and through the most complete knowledge.

In Spinoza's chief work, the 'Ethics,' he attempted to deduce his results from certain fundamental conceptions by the employment of the method of geometry. He even adopted the external form of the Euclidian geometry, beginning each of the five parts into which the work is divided with definitions, axioms, and postulates, and advancing by demonstrating in a formal way a series of definite propositions. This geometrical form adds nothing to Spinoza's work, and is, indeed, in many respects a drawback, since it gives to his profound insights an appearance of artificiality which tends to obscure their real meaning. But Spinoza, as Descartes before him, believed that mathematics furnished the universal type of true science, and he assumed that the absolute certainty, which was then generally regarded as essential to science, could only be attained by following the same method. As has already been remarked, however, the value of Spinoza's philosophy does not at all depend upon his use of the mathematical method. What is most valuable in his system is not the result of his formal deductions, but of his genius as shown through his wonderful speculative intuition and keen psychological analysis.

In spite of the scholastic terminology in which Spinoza's views are often expressed, his system grew out of the modern scientific conceptions which he had learned mainly from Descartes (q.v.). He was also influenced by Giordano Bruno (q.v.), and by his studies in Hebrew theology and philosophy. Spinoza's fundamental thought is that of the unity of the different forms of existence in one all-embracing whole or substance. There is but one substance, one absolutely independent being, which includes all things, and determines itself and all things through the necessity of its own nature. Spinoza calls this one substance God; but his conception is very different from the ordinary theological one. In the first place the world is not regarded as dependent on the will of God, but as the necessary result of his nature or essence. Everything necessarily follows from the nature of God, just as the properties of the triangle or circle follow from the nature of these figures. The bond which necessarily unites all of the parts of the universe to the common centre or substance, and thus to each other, is not causal in the usual sense of that relation, but rather logical. God is the underlying ground from whose nature or essence all things proceed in a regular and uniform order. God does not act as a man acts by setting plans or purposes before himself and then proceeding to realize them, nor has he emotions or passions like men which move him now in this direction and now in that. Spinoza satirizes unsparingly the external teleology and anthropomorphism of his day which sought to explain the course of natural events by referring them to special ends and purposes on the part of God. For Spinoza, God is not transcendent, existing apart from nature, but nature itself as an active self-determining process (*natura naturans*) is God. The one infinite substance, or God, has an infinite number of attributes, but it is known to us solely through the two attributes of extension and thought. Thus every physical thing is a mode of extension, and every idea a mode of the attribute of thought. The physical and the psychical are not independent substances, as Descartes supposed, nor is there any interaction between them. The truth is, that physical things and thoughts are modes which express the nature of the one substance, but each side expresses this nature in terms of a different attribute. Yet though there is no interaction there is an exact correspondence between the modes of extension and the modes of thought: «the order and connection of ideas is the same as the order and connection of things.» This is Spinoza's statement of the Parallelism (q.v.) of mind and body, a doctrine which he was the first to maintain. He develops this theory in some detail, defining the mind as the «idea of the body,» and emphasizing the correlation between the perfection and development of the body and the effectiveness and sanity of the mind.

It is with the problem of man's place in nature,—his relation to God or the total system of things, and the possibility of his freedom,—that Spinoza is most directly concerned. Here he shows that the possibility of man's freedom depends upon his first recognizing that he is a part of nature, and that his mind, like everything else, is subject to uniform natural laws. Man forms no «kingdom within a kingdom»; it is not contingency or some strange power of free will which governs his mental experiences; but here as elsewhere all takes place according to law and necessity. «Nature's laws and ordinances whereby all things come to pass and change from one form to another are everywhere and always the same. There should, therefore, be one and the same method of understanding the nature of all things whatsoever, viz., through nature's universal laws and rules.» Accordingly he proceeds: «I shall consider human actions and desires in exactly the same manner as though I were concerned with lines, planes, and solids.» From this standpoint he gives a scientific account of the origin and nature of the emotions, showing how they necessarily arise from certain assignable causes, and how their intensity depends on definite natural conditions. The various emotions are all found to be compounds of the primary states, pleasure, pain, and desire. But this reduction of the emotions to law is only a preliminary step in Spinoza's treatment. To attain freedom, it is first necessary to recognize the bondage of man, the fixed determination of the emotions through natural laws. But just as knowledge is power in regard to external nature, so we can free ourselves from the emotions by understanding their laws. The mind is, after all, something more than a series of passive states. Its essence consists in an effort to preserve its own being, to promote its own good. And in carrying out this purpose it finds that nothing is so serviceable as knowledge. Through knowledge it is possible to free man from the bondage of the emotions. An emotion when understood becomes transformed and ceases to be a mere state of passivity. Moreover, when the conditions of an emotion are understood, it

Digitized by Google

is possible to arrange and associate the various emotions in such a way as to strengthen and promote the occurrence of those that are desirable, and to weaken and repress those which are hurtful. The highest kind of knowledge for Spinoza is not scientific reason, but intuition, the direct insight that all things follow necessarily from the nature of God and hence form one system. To see all things, not as a series of events in time, but in their necessary logical relation to God, is what Spinoza calls viewing the world under the form of eternity (*sub specie æternitatis*). And this highest knowledge gives rise to the intellectual love toward God (*amor intellectualis*) which is the highest good or blessedness for man. It is through the strength of this emotion, which is not a passion but the highest activity of mind, that the other emotions are most successfully governed and transformed. This intellectual love toward God enables the mind to renounce entirely all finite or personal desires, as well as all envy and jealousy. "He that loves God does not demand that God should love him in return"; he demands nothing for himself, but acquiesces completely in the order of the universe. Moreover, Spinoza argues that since this knowledge and the intellectual love to which it gives rise are eternal, the mind which experiences these must have something in it which is eternal and which cannot be destroyed with the body. Scholars, however, maintain that it is still doubtful whether Spinoza pronounces in favor of individual immortality. An interesting feature of Spinoza's philosophy is the close relation which he always recognizes between the individual and society. It is no merely individual good for which he was seeking, but one which as "many others as possible" might share with him. In numerous passages he approached very near to the modern conception of the individual as standing in an organic relation to society.

For about a century after Spinoza's death his philosophy was wholly neglected, and his name used by both orthodox and unorthodox writers in a depreciatory way as that of an utter atheist who deserved little attention. Lessing was the first thinker who knew and appreciated Spinoza, and a controversy after his death between Mendelssohn and Jacobi as to Lessing's real opinions did much to spread a knowledge of the system in Germany. Goethe was deeply influenced by Spinoza and helped to awaken interest in the Spinozistic philosophy. Thus, since the beginning of the 19th century, Spinoza's ideas have affected in important ways the development of modern thought. It was Novalis who called Spinoza "The God-intoxicated man."

Bibliography.— The standard edition of Spinoza's works is that edited by Van Vloten and Land (2 vols., 1882–83; also in a cheaper form, 3 vols., 1895). The chief works have been translated into English by R. H. M. Elwes (Bohn Library, 2 vols.). The 'Ethics' and the 'Improvement of the Understanding' are also translated by W. H. White and Miss A. Stiling (2d ed. 1899), and the 'Ethics' in part by George S. Fullerton in 'The Philosophy of Spinoza' (2d ed. 1894). The best general commentary in English is Sir F. Pollock's 'Spinoza: His Life and Philosophy' (2d ed. 1899). Consult also: J. Caird, 'Spinoza' (Edinburgh, 1888); H. H. Joachim, 'A Study of the Ethics of Spinoza' (Oxford, 1901); R. A. Duff, 'Spinoza's Political and Ethical Philosophy' (Glasgow, 1903).

JAMES E. CREIGHTON,
Professor of Philosophy, Cornell University.

Spir'acles, the apertures on the sides of the body in insects, centipedes, spiders, etc., through which air is admitted to the breathing organs or tracheæ. See INSECTS.

Spiræ'a, a genus of deciduous shrubs of the order *Rosaceæ*. The species (about 50) are natives of the northern temperate zone; but, being widely popular in shrubberies, an enormous number of varieties have been produced, and the plants have been introduced into southern temperate countries, where some have escaped from cultivation. They are medium or small shrubs with usually little leaves and corymbs, panicles or umbels of white, pink or light crimson flowers, which appear either in profusion for a short time in spring or more sparsely and for a longer period during summer. The various species and varieties are adapted to a wide range of soils and situations, from swamp to rocky hillside and from the full glare of the sun to shade. Consult: Baily, 'Cyclopedia of American Horticulture' (New York 1900–2).

Spiral. See CURVES; SPRING.

Spire, a sharply pointed, tapering roof, most commonly the roof of a tower, though a light structure often set at the crossing of the roof in a cruciform church is also called a spire (French, *flèche*), the term covering the lantern with upright sides from which the pointed roof springs. The term is hardly applied to a roof of which the slope is less than an angle of 60° with the horizon, and even a slope of that acuteness makes a blunt spire.

Spires may be formed of wood and covered with wood or metal or even tiles, exactly like an ordinary roof of lower pitch, but the aim has always been to build the whole of stone and top it with a cross or a finial of leafage, or both.

The spire is associated with mediæval building in the west of Europe, and its greatest development is of the years 1180 to 1500 A.D. In later Gothic art the spire loses its character of roof in that its surfaces are occupied with open or pierced tracery, as in the German churches of Freiburg in Baden, and Thann in Alsatia (Alsass), and the cathedral of Burgos in Spain. In the granite-building country of Brittany this decoration is common, though the openings are smaller and the spires look more massive. The latest development is that seen in Antwerp Cathedral and in Strasburg Cathedral. At Strasburg the roof lines have disappeared and the spire is a cage of sloping bars of stone which carry an indefinitely great number of pinnacles; and in Antwerp a series of vertically-walled lanterns are surrounded by bold pinnacles which are themselves spirelets of considerable size, the whole tapering to the cross. Other spires of the same 15th century and 16th century Gothic have pierced galleries or open stories of arched work alternating with the solid and roof-like slope of the spire. Such a one is the famous north tower of the Cathedral of Chartres.

The highest spires existing are those of Cologne Cathedral (modern from ancient design),

Digitized by Google

514 feet from pavement to top of cross; the Church of Saint Nicholas at Hamburg, 475 feet 6 inches; Strasburg Cathedral, 465 feet; Church of Saint Martin at Landshut in Lower Bavaria, 462 feet; the Church of Saint Stephen, Vienna, 450 feet; Antwerp Cathedral, 407 feet 6 inches; Salisbury Cathedral, 400 feet. Structures in metal are not considered here.

RUSSELL STURGIS.

Spires, spīrz (German SPEYER, spī'ĕr), Germany, in Bavaria, capital of the district of Pfalz, at the confluence of the Rhine and the Speierbach, 10 miles southwest of Mannheim. It is an important government town, ancient royal residence, religious centre of various denominations, and the seat of the Germanic Diet. The chief glory of the town is its cathedral (1030) begun by Conrad and completed by Henry IV. (1061). It has been embellished by frescoes and statuary, and the ashes of eight German sovereigns repose within its walls. Other interesting buildings are the Retscher palace, the consistory, the gymnasium, a Roman Catholic seminary and other institutions, hospital, orphanage, a real-school, and a museum containing German antiquities. The important industrial works include foundries, cotton mills, breweries; the manufacture of machinery, tobacco, and leather goods. The Reformers here first protested (1529) against existing Catholic dogmas and institutions.

Spirit-duck. See BUFFEL-HEAD.

Spirit, Holy. See HOLY GHOST.

Spirit of Laws, The («Esprit des Lois»), a work by Montesquieu, published in Geneva 1748. This work is regarded as the most important literary production of the 18th century, before the appearance of the 'Encyclopedie.' It is a philosophical treatise dealing with the interrelation and interaction of human laws and institutions with natural laws. At the outset the forms of political government are described as three, named democracy, aristocracy, and monarchy. The principles of each are examined and their influence upon education, social conditions, military strength, individual liberty, taxation and finance in a nation are traced. The influence of physical conditions, such as the nature of the soil and climate of a country on political and social institutions is noted. The work embraces also an examination of manners, customs, trade and commerce, family life, jurisprudence and religion of the countries where each form of government severally obtains. Its design was to awaken a desire for freedom, to rouse general condemnation of despotism and kindle the hope of political progress.

Spirit Level, an instrument used by surveyors and others for determining a line or plane parallel to the horizon and also the relative heights of two or more stations. It consists of a glass tube nearly filled with alcohol, preferably colored. The remaining space in the tube is a bubble of air, and this occupies a position exactly in the middle of the tube when the latter is perfectly horizontal. The tube is mounted on a wooden bar, which is laid on a beam or other object to be tested; or it is mounted on a telescope or theodolite, and forms the means of bringing these instruments to a level, the slightest deviation from the horizontal position being indicated by the bubble rising toward the higher end of the tube. The spirit level quadrant is used for taking altitudes.

Spirit Plant, called the Holy Ghost Flower, an orchidaceous plant (*Peristeria elata*) of Central America, known also as the *dove-plant*, from the resemblance of the united stamens and pistil of the flower to a dove hovering with expanded wings, somewhat like the conventional dove seen in artistic representations of the Holy Ghost. It has a spike of almost globose, sweet-scented flowers of a creamy white, dotted with lilac on the base of the lip.

Spiritual Corporations, in the law of England, corporations, the members of which are «spiritual persons» or clergymen, incorporated for the furtherance of religion and perpetuation of the rights of the church. The laws of the States of the American Union do not recognize any difference between ecclesiastical (or spiritual) and other corporations: the same statutes apply to both kinds of corporations.

Spiritual Exercises, The. The author of the 'Spiritual Exercises' is Saint Ignatius Loyola. They were composed by him when he was living as a hermit in the Cave of Manresa. If we would have an exact definition of them, they may be said to be an exercise of the soul, by which, in the presence of God, a man meditates in silence and retreat upon the eternal truths, and by the light of these examines his spirit, with a view to correct what is wanting, and give that direction to his life which shall be most pleasing to God and most useful toward his salvation.

The development of the idea of the Exercises shows us their aim and purport. They tend entirely to discover for us the one end necessary to man in time and in eternity, and the means of attaining it in the best and surest manner that is possible in our present condition. We give the words in which the saint expresses himself with regard to his Spiritual Exercises. Their end is «to prepare the soul, and properly dispose it to lay aside all inordinate affection, and then to inquire and discover how God would have it set its life, in order to gain eternal salvation.»

He who makes the Exercises must pass through several stages, each of which brings him to a separate conclusion. These stages form in respect of time the four divisions called weeks, and correspond, as to the end they have in view, to the three ways — the purgative, the illuminative and the unitive. The sinner needs purification and every one requires to know what sin is, and what are its consequences. The whole of the first division or week, which may occupy more or less time than an ordinary week, is devoted, according to the wants of each, to the accomplishment of this object through the exercise of the powers of the soul, producing in it repentance and hatred of sin as the fruit of the Exercises of this first part. The second and third weeks comprise the paths in which the soul must walk after having been purged from the vices which made it ill, in order to obtain that perfect health which consists in the knowledge and practice of the will of God. It is then that it makes choice of the state of life in which God would have it serve him, or reforms its life in the state of which it has already made choice. These meditations, in their turn, prepare the soul for the concluding stage, contained in the

Digitized by Google

last week of the Exercises, the object of which is to unite the heart indissolubly and forever to God after it has become detached from the love of this world.

The subject matter of the Exercises accords with this idea and with the end they have in view. In order to build on a solid foundation, they begin by a meditation on the end of man, since this final cause must exist before the being who is created for it. The first question which man ought to ask himself is, "Why am I in this world"? The Exercises begin by answering this question. They tell us, "Man is created to praise God, that is, to honor him and to serve him, and so to save his own soul. Everything that is upon the earth has been made for man, that it might aid him in attaining to this end for which he has been created." Meditations on Sin, Death, Hell and Judgment follow on this fundamental truth and constitute the work of this first part of the Exercises.

The second part begins, like the first, with a principle or a foundation, that, namely of vocation. The old world has passed away, a new world begins. God says: "Let us redeem man." And accordingly this week commences with the meditation of the kingdom of Jesus Christ, who is represented as solemnly inviting all men to follow him, as subjects follow their king, on the condition of suffering nothing which he has not suffered before them. Then succeed the meditations on the life of Christ, beginning with his Incarnation and Nativity.

Then follows the third week with the meditations on the Passion of the Divine Master, whence is drawn the strength and energy needed in combating the enemies of salvation, and the power from on high which will confirm and seal the choice which is made.

In the fourth and last week the exercitant is engaged in considering the mysteries of Our Lord risen from the dead until his Ascension. In these he learns how the spiritual man is perfected and completed. And he concludes by meditating, not, as might be imagined, on the union which we shall one day enjoy with God in glory, but upon the means of attaining charity, which is the practical object and corollary of the Exercises, and the constant aim of our efforts in this world.

It may be asked, how did the Exercises of Saint Ignatius bring about such marked effects as to render their name so famous? They are after all only meditations on the old grand truths of Christianity. Why is it that these same truths have always had, and even at the present day still have, so powerful an effect on those who make the Exercises, that more than once the ignorant attributed it to magic? What alone gives to the Exercises their wonderful efficacy, is that they are an active prayer, and a practical meditation of the fundamental truths, which simply read or heard, would make a feeble and superficial impression.

Here man brings home to himself these truths which have to him a personal interest, and this one object he always keeps before him. We must also look for the cause of their wonderful efficacy in the study of them in detail, and in the order and relation given to these truths in their relation to the wants of the soul so that no other form or method than this could well be employed.

The celebrated Spanish theologian Torres, explains in these terms how they could have so great an effect upon learned men, who take them in good faith and in earnest: "In my first studies," he says, "I had for my object the gathering of knowledge; but I made the Spiritual Exercises in order that I might practise them, for there is a great difference between knowing a thing for the sake of knowing it, and knowing it for the sake of doing it."

T. J. Campbell, S.J.

Spiritualism (from the Latin *spiritualis*, spiritual, and this word again from *spiritus*, breath or life or soul). This word has been used by certain extremists in different ages to signify the doctrine that all which exists is spirit or soul, but its established meaning is the doctrine that those who have departed from this life are able, under favorable conditions, to communicate with the mortals left behind, or project certain forces upon them. This is generally done by aid of those whose psychic nature has been well developed or whose aura furnishes a chemical combining agent, by means of which force can be manifested to the outer world. Such persons are termed mediums or psychics.

The phenomena on which spiritualism depends have been known more or less in all ages, the era of Christianity, especially being one of the great revivals of spiritualistic influence. "It (spiritualism) has been the very life blood," says Epes Sargent, "of all the world's serious religions." Its modern revival, beginning in 1848 at Hydesville, a small village in the State of New York, aims, for the first time, to develop the subject on a scientific basis. A brief setting forth of its claims, its rationale, its limitations, its perversions and also its great achievements, may be attempted here.

First, every human body is dual in its nature, consisting of the ordinary coarse material form and a similar interior form which is also material, but so refined as to elude the outer vision. This interior body is sometimes called the "spiritual body," or the psychic body, or the astral body. Scores of cases can be cited in which persons in the psychic body have been able to look down upon their coarser form and move around in all directions with only a magnetic cord connecting the two. The greatest power inheres in fineness and the psychic body, when unimpeded, is far swifter, clearer in intellect and more potent in action than the outer body. This body, combined with a portion of Infinite Spirit, constitutes what in this life is termed the soul, or when its cord is sundered it becomes a spirit, and goes forth into a more ethereal life.

A person of strong psychological power is able to charge up the brain of a sensitive subject with an amount of psychic force in addition to the sensitive's own, that will enable the psycho-mental system to predominate over the animo-mental, in a way at times to hold the motor-nerves rigid and prevent all power of motion; or the sensory nerves, to prevent all power of sensation. The operator then having the subject under control can will him to think or say whatever he chooses and we call this a state of hypnosis, or better, of psychoma. To illustrate what grade of fineness is meant by

Digitized by Google

psychic force, can best be done through the different grades of color. Those sensitives who can attain to psychic vision are able to see two octaves of color higher than those of the outward eye. Thus, they can see not only the scale of red, orange, yellow, green, blue, indigo and violet, but a second and more refined scale of the same colors, including the X-ray, and even a third scale, called also the psychic, which is indescribably beautiful. The psychic atmosphere and the psychic lights are just suited in fineness to the psychic body. This grade of lights and colors is the finest that mortals have thus far been able to reach, and being so refined as to penetrate opaque substances, the high-grade seer, who can get en rapport with it, will be able to look through human bodies just as the outward eye can look through glass. Such a one must see through the eyes of the psychic body and is termed a clairvoyant, and hear through the ears of the same body, becoming thus a clairaudiant. What, then, shall hinder him from seeing the forms or hearing the words of those spirits who have attained to psychic life, and especially those who have reached only the second grade of development.

The psychomic condition induced by earthly operators is called a mesmeric or hypnotic sleep, but when induced by spirits is called a trance. The bodily organs are held in abeyance, being asleep, but the psychic nature, being set at liberty, is doubly active. But it should be understood that this linking of a visible with invisible worlds is a great undertaking and is liable to imperfections and drawbacks and limitations. The medium is perhaps imperfectly developed and the spirit striving to send his ideas through a foreign brain and a foreign atmosphere, cannot overcome the preconceived ideas of its instrument, so that the result may be a communication with more of the medium than the spirit in it. Again, certain spirits have attempted to locate mines and tell where wells should be sunk, and persons having implicit faith in them have exhausted themselves financially in vain in the matter. To be sure various persons have been made wealthy by the higher help, but high influences will not assist in money getting except for some noble purpose. Not very many mediums are able to give so arbitrary a thing as a name. Great intellects in the higher life, may give a psychic higher conceptions than he had before, but very great things cannot usually be transmitted unless the psychic himself has some largeness of conception. The medium needs to understand mental forces. At times he may see human forms as large as life moving around him and hear voices, all of which he may describe to the sitter as spirit manifestations, whereas it may be simply the images that have been photographed and phonographed upon his own sensorium, from the experiences of his daily life. He must judge of genuine spirits by their greater brightness and by the points of identification agreed to by the sitter. The sitter himself is liable at times to receive implicitly the words of the medium. The spirit, unhampered by a gross fleshly body may give some wonderful truths and even prophecies, which fact often leads sitters to deem them infallible, a condition of mind that all the higher influences deprecate as interfering with their own reasoning powers.

Obsession or the control of low grade spirits, sometimes works injury to both moral and physical conditions of a sensitive, but not to such an extent as is feared by our church members, who are usually quite ignorant of how to deal with such cases. In revival meetings, some persons get what is called «the power,» and occasionally are allowed to die from having no one to pass off the excitement from the brain. Those who feel a debasing influence coming upon them, should use their will power mightily against it, and if not thus able finally to succeed, should ask a little circle of friends, one of whom should be a medium, to form around them.

Complaints are made against spiritualism as leading to laxity of morals, and a prejudiced press spreads every hostile report far and wide. It is true that every new era of greater freedom develops some people who rush to extremes, just as some early Christians did, but statistics go to show that a great and salutary work has already been wrought by its means. Among 17,000 prisoners in the United States and Canada, not one spiritualist was discovered, while thousands of sectarian religionists were to be found. Notwithstanding all the drawbacks, imperfections, disputations, clashing of theories, and the unloveliness of necessary iconoclasm, which the superstitions of the age have required, there are grand and revolutionary movements which spiritualism has inaugurated, and which every true philosopher must be willing to have considered. Many persons of general intelligence are so ignorant of the work that is going on in this direction as to declare that spiritualism has done harm and no good. The cause of supreme truth then demands that the following facts should be set forth.

1. *It Proves Immortality.*— Thomas Buckle, author of the 'History of Civilization,' says: «Immortality is the doctrine of doctrines: a truth compared with which, it is indifferent whether anything else be true.» Several millions of persons in Europe and America, including some of the most eminent scientists and literati, have received convincing proofs that human beings survive the change of death. If this be true in the midst of corrupting influences of this earth, how doubly sure of surviving must the soul be in the more ethereal existence that follows death.

2. *It Leads Off in Human Reforms.*— William Lloyd Garrison, an earnest spiritualist, was the pioneer of the anti-slavery movement. Rev. John Pierpont, at one time president of a United States Spiritual Convention, was the leading pioneer of the temperance reform at a time when alcoholism was almost universal. The leaders in the woman's rights movement are and have been largely spiritualists. Medical reform has proved of great importance. At a time when physicians were administering huge doses of toxic drugs, which left paralysis and neuralgia in their wake, a large number of people felt an enkindling power that enabled them by means of touch, on the apostolic plan, to heal multitudes of severe cases, some of which were called miraculous. Some were enabled to project their magnetic aura to long distances, which, striking some poor invalid as with the shock of

Digitized by Google

a magnetic battery, would heal him in a moment. The interest in all mental and natural forces was awakened, including water, air, exercise, electricity, movement and that greatest power of nature, sunlight. But these hard workers, by methods so safe and potent, could have done a far more effective work, if they had not been hampered by despotic laws, enacted to gratify physicians, threatening fine and imprisonment against all who should heal or save life without having gone through a four years' medical course, very much of which had no bearing on their methods of cure.

3. *Spirit Communion Has Promoted Civil and Religious Freedom.*—One of the great steps of national progress occurred through the mediumship of D. D. Home, the favorite psychic of kings, during the reign of Alexander II., at his royal palace in Saint Petersburg. Nicholas, the father of Alexander II., materialized to such an extent as to be readily recognized by his son and then commanded him to free the serfs of Russia. Alexander, after being prostrated for two weeks, rose from his bed and sent out his royal ukase, freeing 40,000,000 serfs. It is said that the Emperor Joseph of Austria was induced to grant religious freedom to his subjects by his prime minister, who, being mediumistic, received the inspiration from the higher life. Victor Emanuel, king of Italy, for years submitted his state papers to the higher influences, and by them was nerved up to his bold and successful movement by means of which Italy entered upon a new and freer life.

4. *Spiritualism Has Made Known a Higher Science.*—The ordinary scientist has reached immutable ground in the line of mathematics and of course has gathered a vast thesaurus of facts for the world's illumination, but has shown a great lack of acumen in his perception of the subtle underlying principles of things; has mistaken the laws of force as everywhere revealed in nature; cannot tell the nature of the ubiquitous force of electricity, whether it is a substance, or a law of motion, or both; is equally at sea with reference to its contrast, thermism; is ever in the mist as to the nature of light and its constituent colors; writes great volumes on chemical force, but is quite ignorant of its process of action, although chemism is perhaps the most important law of the universe, embracing mental as well as physical force; does not understand nerve force or how it acts; cannot explain even so simple a thing as muscular action; writes great volumes on physiology and psychology and yet does not understand respiration, or pulsation, or the leading vital processes, or hypnosis or the higher phases of mental action. These things and much more have already been explained and given to the world by the aid of those great intellects that by far transcend all earthly minds and whose piercing vision goes immensely beyond all possibilities of mortals.

5. *Spirit Influence is a Great Illuminating Power.*— Many great poets, orators, musicians, seers, artists, and other geniuses of the world have owed their greatest achievements to inspirations from the wiser life. Dr. J. M. Peebles of Battle Creek, Mich., in his excellent work called 'Seers of the Ages,' shows that the geniuses of all ages have been conscious of a higher help. Among the names he gives are those of Mozart, Beethoven, Raphael, Tasso, Schiller, Henry Ward Beecher, Harriet Beecher Stowe, Lao-tse, Confucius, Zoroaster, Hesiod, Homer, Plato, Socrates, Pythagoras, Cicero, Swedenborg, etc. Later, Dr. Peebles issued a work, called 'Who are these Spiritualists?' in which he gives several hundred prominent professors, scientists, judges, literati, kings, etc. Among those who felt the enlightening influence of the spirit was Hudson Tuttle, of Berlin Heights, Ohio. He was an uneducated farmer boy, but between the age of 16 and 18 he was influenced to write the 'Arcana of Nature.' Two editions of this have been published in England and it was translated into German. One of the eminent Germans, Dr. Louis Buechner, pronounced it "far in advance of the profoundest scientist of the day." A. J. Davis, M.D., while a boy of 14 years, commenced the large work 'Principles of Nature, Her Divine Revelations.' This was given in a kind of a mesmeric trance, assisted undoubtedly at times by the higher wisdom. Dr. Bush, a learned Swedenborgian, was astounded at the sublime flights of thought therein manifested. Thirty-four editions have been published. It was a forerunner of Spiritualism. The reader who wishes to perceive some of the possibilities of a human mind should read 'The Magic Staff: an Autobiography of Andrew Jackson Davis.'

6. *Spirit Communion Robs Death of Its Terrors.*— When one can look into the next life and perceive that the transition is not "a leap into the dark," surrounded by blackness and superstition, it is an immense relief.

7. *Spiritualism Confirms Many of the Bible Representations,* and leads many skeptics and agnostics to revise and change their ideas. John Wesley, the founder of Methodism, had, according to Robert Southey, "Spiritual manifestations in his house for over 30 years, commencing with 1716," and rejoiced in them as proving immortality. Speaking of skeptical scientists, Wesley says, "They well know (whether Christians know it or not), that the giving up of these apparitions is in effect giving up the Bible; and they know on the other hand, that if but one account of the intercourse of men with spirits is admitted, their whole castle in the air (deism, atheism, and materialism) falls to the ground." The churches at present are not so logical as Wesley was. The Bible says, "Try the spirits," "Cultivate spiritual gifts," "Despise not prophesyings," "Quench not the spirit," "Prove all things," etc. The Church says beware of these things, and is alarmed at such passages as the following: "It shall come to pass in the last days, saith God, I will pour out my spirit upon all flesh; and your sons and your daughters shall prophesy, and your young men shall see visions, and your old men shall dream dreams." (Acts II., 17.) But there are many scores of passages in the Bible in which spiritual manifestations are referred to, the more degrading ones being condemned, just as they are at the present day.

8. *Spiritual Illumination Reveals the Sublime Possibilities of the Human Soul,* including its power of psychometry, of clairvoyance, of clairaudiance, and its grasp of higher science compared with which ordinary science has

Digitized by Google

reached only the beginning of things. Psychometry proves that every particle of matter has been stamped with the experiences and history of the surrounding world and is forever radiating this history outward so that a human sensitive can perceive it. Prof. Denton's 'Soul of Things' in three volumes and Dr. J. R. Buchanan's 'Psychometry' in one volume, will portray the marvels of this science. Clairvoyance reveals a more glorious universe within a universe, compared with which the outer cosmos is gross and imperfect. But the ordinary scientist has dwelt so long among ruder elements as to find it difficult to grasp these subtler forces even when explained to him, and is apt to attribute the matter to some magic, although the greatest magicians, including Houdin, the prince of magicians, Bellachini, the court conjurer of Berlin, Herrman, Jacobs, Rhys, and others have all given up the mediumistic phenomena as beyond the power of prestidigitation. The mere spiritist aims only at the material or selfish features of mediumship: the true spiritualist, while giving due place to material things, cultivates a beautifully sympathetic and spiritual nature, combining both religion and philosophy; religion to lift the soul upward, and philosophy to guide it toward all truth.

Statistics.— From the secretary of the National Spiritualist Association for the United States and Canada the following statistics are given: «There are about 660 local societies of Spiritualists in the United States and Canada — 19 State associations in the United States and 52 camp-meeting associations. About 150,000 persons belong to Spiritual societies in the United States and we estimate about 1,500,000 of avowed Spirituals in the United States and Canada. About 1,500 mediums are before the public and perhaps 10,000 others exercise their gifts in their own homes or among a few friends only.»

Bibliography.— Edmonds and Dexter, 'Spiritualism' (1853); Kardec, 'Livre des Esprits' (1853); Zöllner, 'Transcendental Physics'; Crookes, 'Researches in the Phenomena of Spiritualism' (1874); Wallace, 'Miracles and Modern Spiritualism' (1881); Wundt, 'Der Spiritismus' (1879); Home, 'Gift of D. D. Home' (1890); Home, 'Lights and Shadows of Spiritualism' (1877); Aksakoff, 'Animismus und Spiritismus' (1890); Adare, 'Experiences with D. D. Home'; Brofferi, 'Perlo Spiritismo' (1893); Moses, 'Spirit Identity' (1879); Von Hartman, 'Der Spiritismus' (1885); Peebles, 'Immortality, and Our Employments Hereafter'; Babbitt, 'Religion as Revealed by the Material and Spiritual Universe'; King, 'Real Life in Spirit Land'; J. R. Francis, 'The Cyclopedia of Death'; Hull, 'Encyclopedia of Biblical Spiritualism'; Wallace, 'Defence of Modern Spiritualism'; Epes Sargent, 'Scientific Basis of Spiritualism.'

E. D. Babbitt, M.D.,
Institute of Higher Sciences, Rochester, N. Y.

Spiritualist Association, National, The, is composed of chartered spiritualist societies of the United States and Canada and holds a delegate convention annually. The association has issued about 330 charters, 20 of which were made to State associations. The society owns numerous church buildings.

Spirom'eter, a contrivance for determining the capacity of the human lungs. The instrument most commonly employed consists of an inverted chamber submerged in a water-bath. The breath is conducted by a flexible pipe and internal tube, so as to collect in the chamber, which rises in the water and is fitted with an index marking the number of cubic inches of air expired after a forced inspiration.

Spir'ula, a genus of diminutive cuttlefishes representing the family *Spirulidæ,* which is distinguished by the possession of an internal chambered shell of nacreous structure and discoidal form, the whorls of the shell being separate, and the siphon piercing the septa on their ventral surfaces. *S. peronii* is a species which inhabits the open ocean, and its shells are occasionally cast ashore. See Cephalopoda.

Spit'head, England, a roadstead which separates the northern coast of the Isle of Wight from the mainland, near the entrance to Portsmouth harbor (q.v.). It is much frequented by the English fleet and protected by strong forts, and extends for about two miles along the southwest side of Spit Sand. It is so safe that it received the title of the «King's bedchamber.» In 1797 it was the scene of a determined mutiny, the sailors striking for better pay, which they obtained.

Spitz, or **Pomeranian Dog,** a small sheep-dog, originally of the Baltic provinces of Germany, which is about the size of the spaniel, with a sharp-pointed face and an abundant white coat sometimes of great beauty. Other colors are known, including black. It is comparatively common in the United States, where it is a favorite dog with Germans. See Dog.

Spitzbergen, spĭts-bĕr'gĕn, a group of islands in the Arctic Ocean, between Barents Sea on the east and Greenland Sea on the west, 400 miles north-northwest of the North Cape in Norway. They lie between the parallels 76° 30' and 80° 30' N., and are about half-way between Greenland and Nova Zembla. The archipelago comprises six large islands and a large number of smaller ones. The largest island is West Spitzbergen, which has a triangular form with the apex pointing south. Its coast is indented by many fiords, of which the two largest are Ice Fiord on the west coast, running north and northeast, and Wijde Bay, penetrating southward from the north coast. The northern branch of Ice Fiord almost meets the head of Wijde Bay. The narrow Foreland Sound separates the smaller island of Prince Charles Foreland from part of the west coast of West Spitzbergen, and to the northeast, separated from the main island by Hinlopen Strait, lies the second largest island, North-East Land. Of the smaller islands Danes Island, off the northwest coast of West Spitzbergen, is notable as the place from which Andrée set out on his fatal balloon voyage to the North Pole. The total area of the Archipelago is about 27,000 square miles, of which West Spitzbergen represents about 15,000. West Spitzbergen is in the main covered with great accumulations of ice, except along the west shore of Wijde Bay, where there is a relatively fertile area. The middle of the island, west of the main watershed, is described as a region of boggy valleys, fertile slopes, and mountain ridges, or the remains of a high plateau.

Digitized by Google

The highest measured peak of the island is Horn Sound Tind in the south, fully 4,500 feet above sea-level. Large glaciers are found throughout the whole group, but especially on the eastern coasts. Geologically the backbone of the island consists of granite, with gneiss and other archaic rocks, but Carboniferous, Triassic, Jurassic, Miocene, and even more recent formations are also well represented. During Miocene times Spitzbergen had a luxuriant flora, and there was also a postglacial period of genial climate favorable to the development of a varied phanerogamic flora. The proximity of the Gulf Stream renders the climate, especially on the west coasts, less severe than that of other places in the same latitude. For four months in winter the sun is below the horizon, and for an equal period in summer always above it. The most characteristic plants of the archipelago are mosses and lichens. Rather more than one hundred species of phanerogams, however, have been collected on the islands. The grasses form nearly a quarter of these, and next to them in number of species are the cruciferous plants. The larger forms of animal life are foxes, bears, and reindeer, in pursuit of which, as well as the walruses and seals abounding along the coasts, the islands are frequently visited by the Norwegians and Russians. Sea-fowl are so numerous that they literally hide the rocks and darken the air. The minerals include beautiful marble and good coal. The group is said to have been discovered (1553) by Willoughby, but the islands were known to the Russians before that time. They were again discovered in 1596 by the Dutch navigator Barents. To the latter navigator the islands owe their name (in Dutch spelling Spitsberghen), signifying "peaked mountains." The coasts of the chief islands have been explored by many expeditions since that time, and during the 19th century the islands were used as a base for expeditions toward the North Pole. The interior was hardly known till the explorations in 1896-7 of Sir W. Martin Conway, who was the first to cross West Spitzbergen from west to east. There are no settled inhabitants, but explorers and others have often passed one or more winters in the archipelago. In the days of the Spitzbergen whale fishery there was a thriving Dutch village called Smeerenberg on a small island to the northwest of West Spitzbergen. Tourist steamers make regular sailings to Spitzbergen during the summer months from Hammerfest and Hamburg. A tourist hotel was built in 1896 at the entrance to Advent Bay, a branch of Ice Fiord.

Spitz'ka, Edward Charles, American neurologist: b. New York 10 Nov. 1852. He was graduated from the College of the City of New York and subsequently (1873) from the medical department of the University of New York, and studied later at the medical schools of Leipsic and Vienna, becoming in the latter institution a laboratory assistant in embryology and histology. On his return to New York he made the nervous system his specialty, and gained national reputation as expert in insanity in the trial of the assassin Guiteau. He is the discoverer of the inter-optic lobes of the lower brain. He was vice-president of the neurology section at the International Medical Congress of 1887, and honorary president of the Pan-American Medical Congress in 1893. He was editor of the 'American Journal of Neurology' (1881-4), and has published a 'Treatise on Insanity'; etc.

Spiv'ak, Charles D., American physician: b. Krementshug, Russia, 25 Dec. 1861. Leaving Russia in 1882, on account of his political views he came to this country and worked as day laborer in New York, as a mill hand in Maine, and as a farmer in New Jersey, until he was enabled to graduate from the Jefferson Medical College, Philadelphia, in 1890, spending some time at the Berlin University (1891-2). In 1894-5 he was chief of clinic, gastro-intestinal diseases, at the Philadelphia Polyclinic. Settling in Denver, Colo., he became lecturer on diseases of the gastro-intestinal tract, Denver School of Medicine (1896-1900), and professor of anatomy at same college (1897-8).

Spleen, a vascular abdominal organ which, in man at least, is now generally regarded by physiologists as forming one of the ductless glands, and which is accordingly classed with the thyroid gland, thymus, and suprarenal capsules. All vertebrates — with the exception of the lancelet, and probably the lampreys, lepidosirens (or mudfishes), and the ceratodus or barramunda — possess a spleen, which is absent from the sub-kingdom in certain aberrant fishes only. In man the spleen lies in the upper part of the abdomen, and is situated in the left hypochrondriac region, contiguous to the cardiac or gullet end of the stomach. Its outer surface is smooth, and lies in contact with the under surface of the diaphragm or midriff, this latter muscle separating the spleen from the 9th, 10th, and 11th ribs of the left side. Externally the spleen is covered by the peritoneum, and is connected with the stomach by the omentum, known as the gastrosplenic band. Its internal aspect is concave, and is divided by a longitudinal groove or fissure named the hilum. The blood-vessels and nerves of the spleen enter and leave the organ by the hilum. Inferiorly the internal surface of the spleen is in contact with the pancreas (q.v.) or sweetbread, and posteriorly with the suprarenal capsule of the left kidney. The upper end is of rounded conformation, and is thick; while the lower extremity is pointed, and is in contact with the colon (q.v.). A suspensory ligament or special fold of peritoneum attaches the spleen to the under surface of the midriff. The size of the spleen appears to vary much. Its average size in the healthy adult is about 5 inches in length, by 3 or 4 inches broad, and 1 to 1½ inches in thickness. Its average weight is 7 ounces.

The spleen is invested by an outer serous membrane formed by the peritoneal layers. It covers the entire surface. Below the serous coat is a second investment of fibrous nature. This is of elastic structure, and forms the framework or supporting fibres of the internal structure. The essential spleen matter is called spleen pulp. It is of a dark brownish-red color, and when microscopically viewed is seen to be composed of colored parts, consisting of red blood corpuscles and other cells of colored nature; while other bodies of deep-red, yellow, or black hue, existing singly or aggregated together, may be seen amid the spleen pulp. The colorless elements seen in the spleen-structure are

Digitized by Google

granular matters, free nuclei of cells, as well as nucleated cells or vesicles. The colorless elements form about two thirds of the pulp and are of the same nature as the round white cells of lymphatic glands (q.v.). They are also similar to white blood-corpuscles. When the spleen is cut through, as in a vertical section, a number of opaque bodies of small size, masses of round cells, are seen to be scattered throughout its substance. They are the Malpighian or splenic corpuscles, which have intimate relations with the veins of the spleen, and resemble lymph-corpuscles (see LYMPH) in form. The splenic artery, supplying the organ with blood, is of large calibre, and pursues a remarkably tortuous course within the spleen. The veins of the spleen, like the splenic artery, are of large relative size, and they unite to form a large (splenic) vein, which pours its fluid into the portal vein. The nerves of the organ are derived from the right and left semilunar ganglia, and form the right pneumogastric nerve.

Modern research has shown that in all probability the spleen is the seat of the change and elaboration of the red blood-corpuscles, which form such characteristic elements in vertebrate blood. It is thus to be regarded as a blood-gland, or kind of lymphatic gland. The spleen may be removed or extirpated, both from man and lower animals, without any apparent bad consequences. This is explicable on the ground that other glands (thyroid, thymus, or even the ordinary lymphatics) may assume the functions of the absent spleen.

Of the diseases to which the spleen is liable inflammation and enlargement are the most common. Inflammation (splenitis) may result in splenic abscess and gangrene; while the organ may be affected by various forms of tubercular and syphilitic disease, and is liable to be ruptured by violence — as from a direct kick or blow. Enlargement (known as ague-cake) results from chronic ague or intermittent fever, and may sometimes be met with in pregnant women, and in leucæmia (q.v.). See INTESTINE.

Spleenwort. See ASPLENIUM.

Splice. See KNOTTING AND SPLICING.

Splint, in surgery, a thin piece of wood or other material, used to hold or confine a broken bone when set, or to maintain any part of the body in a fixed position. There are various kinds of splints, adapted for different purposes. A plaster-of-Paris splint is made by charging a bandage of muslin or other open material with plaster of Paris, and washing over each layer with water. The plaster hardens rapidly.

Splint, in veterinary surgery, a bony enlargement on a horse's leg, between the knee and fetlock. It usually appears on the inside of one or both forelegs, frequently situated between the large and small cannon bones, is due to concussion, and most common in young horses that have been driven rapidly along hard roads before their bones are consolidated. When of recent and rapid growth the splint is hot and tender and causes lameness. A piece of spongio-piline saturated with cold water should be applied to the splint, kept in position with a light linen bandage, and wetted with cold water or refrigerant mixture every hour. Perfect rest must be enjoined for ten days or a fortnight. When the limb is cool and free from tenderness, the swelling, which will still remain, may be greatly reduced by some stimulating applications, such as the ointment of the red iodide of mercury, the common fly blister, or the firing iron.

Splitail, a Californian chub (*Pogonichtys macrolepidotus*), dun colored with silvery sides and the tail divided into two lobes, of which the upper is much the longer; length, 12 inches. It is common in all the lowland streams of central California.

Splü'gen, Switzerland, in the Alps bordering the Italian frontier, is a lofty mountain 9,350 feet high, with a pass connecting the Rhine Valley of the Grisons, with the valleys of Lombardy. The pass, though known to the Romans, was of a dangerous character, because of frequent heavy avalanches. A French army in 1800, traversing the old path, lost a great number of men and horses overwhelmed by avalanches. The modern pass completed in 1823 by the Austrian government, contains several galleries of massive masonry as a protection against the descent of avalanches. It rises 6,940 feet above sea-level, and is a bold piece of Alpine engineering. There is a small inn at a high point for the refuge of travelers, and a hotel at Monte Spluga. The scenery comprising deep cascades, sharp rocks, wild ravines, and snowy peaks, presents a variety of magnificent views.

Spodumene, spŏd'ū-mēn, a mineral occurring generally in monoclinic crystals often of great size. It has a well developed cleavage, most perfect parallel to the orthodiagonal axis, and to the prism planes. It is not unlike feldspar in appearance, but may be distinguished from that mineral by its higher specific gravity, (3.13 to 3.19) and its more pearly lustre. Its hardness is 6.5 to 7 of the scale, and its color grayish-green, passing into greenish-white and grayish-white, rarely faint-reddish. Its composition is: Silica 64.2; alumina 29.4; lithia 6.4. In eastern United States it is found at Windham, Maine; Winchester, N. H.; Goshen, Chesterfield and Norwich, Mass., and Brookfield, Conn. It also occurs in Sweden, in the Tyrol, and in Scotland.

Spofford, spŏf'ŏrd, **Ainsworth Rand,** American librarian: b. Gilmanton, N. H., 12 Sept. 1825; d. 11 Aug. 1908. He received a classical education from private tutors, engaged as a book-seller and publisher in Cincinnati, and in 1859-61 was associate editor of the Cincinnati *Daily Commercial*. He was 1st assistant librarian of Congress in 1861-4, librarian-in-chief in 1864-97, and chief assistant librarian till his death. He edited: Catalogues of the Congressional Library; 'Annual American Almanac' (1878-89); was associate editor of: 'Library of Choice Literature' (10 vols.); 'Library of Historic Characters and Famous Events' (10 vols.); 'Library of Wit and Humor' (5 vols.); and has written: Massachusetts in the American Revolution' (1895); 'A Book for All Readers' (1900); etc.

Spofford, Harriet Elizabeth Prescott, American poet and writer of fiction: b. Calais, Maine, 3 April 1835. She was graduated from the Pinkerton Academy in Derry, N. H., in 1852 and was married to R. S. Spofford in 1865. She was one of the earliest contributors to 'The Atlantic Monthly' her story 'The Amber Gods,'

Digitized by Google

attracting the attention of discriminating readers as much for the tropical luxuriance of its style as for the theme. Her earlier work in both verse and prose is in every case marked by originality and distinction of style, which however, does not appeal to the average taste, but her later work, while not without charm, is more conventional in character. Among her publications are: 'Sir Rohan's Ghost' (1859); 'The Amber Gods, and Other Stories' (1863); 'Azarian' (1864); 'New England Legends' (1871); 'Hester Stanley and St. Marks' (1883); 'A Scarlet Poppy' (1895); 'In Titian's Garden,' verse (1896).

Spohr, spōr, **Ludwig,** German composer: b. Brunswick 5 April 1784; d. Cassel 22 Oct. 1859. He studied music, and at an early age acquired a great reputation as a performer on the violin. About 1805 he was appointed conductor of the court concerts at Gotha, and became afterward musical director of the Theatre an der Wien, Vienna, for which he wrote some of his finest dramatic works. He became chapel-master at Frankfort 1817–19, and at the electoral court of Hesse-Cassel in 1822, and continued in that office till near the end of his days. Spohr was the composer of violin music, consisting of solos, concertos, and chamber-pieces, and his performance on that instrument was characterized by breadth and vigor of tone. He is also the author of 'Faust' (1818); 'Jessonda' (1823); 'Zemire und Azor' (1819), and other operas, which occupy a high rank among musical compositions. His oratorios, 'The Last Judgment' (1826); ('Die letzten Dinge'), 'The Fall of Babylon' (produced first at a Norwich musical festival), and 'Calvary' (1835), ('Des Heilands letzte Stunden'). His music is deficient in melody, and its technical excellence appears only to persons thoroughly conversant with high musical art.

Spoils System. See CIVIL SERVICE REFORM.

Spokan'. See SALISHAN INDIANS.

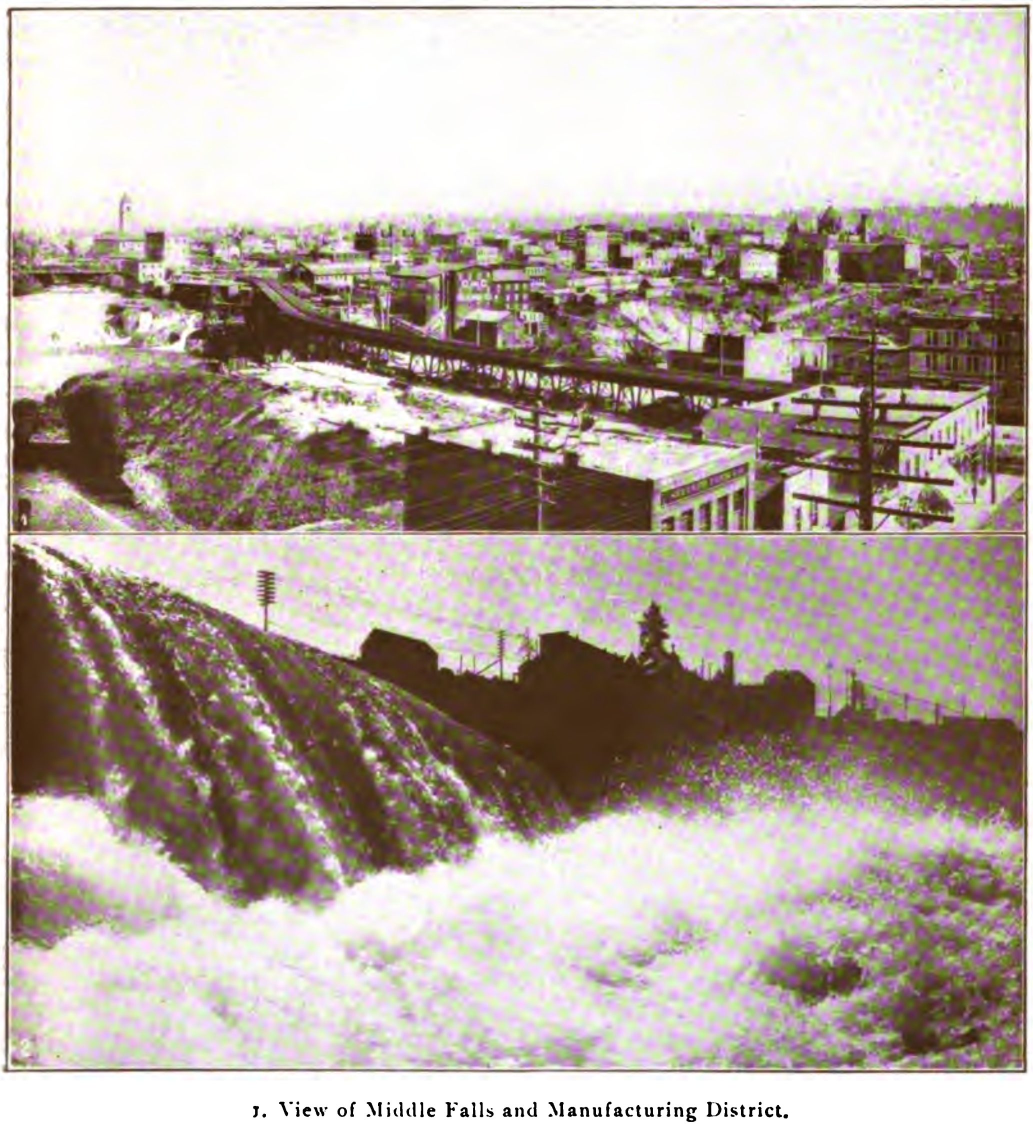
Spokane, Wash., city, port of entry, county seat of Spokane County; and the commercial centre of the interior Columbia River basin. Spokane is named after an Indian tribe, meaning "Children of the Sun." The place was originally called Spokane Falls, so named from the beautiful falls of the Spokane River. The city is situated on the Spokane River, and on three transcontinental railroads, viz.: The Great Northern; the Northern Pacific, and the Oregon Railroad and Navigation Co. (Union Pacific system), about 16 miles west of the boundary line between Washington and Idaho, and 350 miles east of Seattle. There are eight branch line railroads, and one electric line, which connect Spokane with the surrounding territory, comprising Eastern Washington, Northern Idaho, and Southeastern British Columbia. The falls at Spokane are 132 feet and furnish 33,000 horse power at the lowest stage of the water, which is used for electric railways, lighting, mining, and manufacturing. Electrical power is transmitted 100 miles to the famous silver-lead mining region of the Cœur d'Alenes, Idaho, which produces one-fifth of the lead bullion of the world. There are 23 bridges, railroad and carriage, one a cantilever, 1,210 feet long. The Federal census of 1910 ranks Spokane as the second city in the State in population and manufactures. The gain in population from 1900 to 1910 was nearly 300 per cent. The school census, city directory, and recent bank clearings indicate that Spokane ranks as the second city of the State in population and commerical importance.

Industries—The Federal census of 1909 reports the number of industrial establishments in the city, 286, with capital invested, $16,434,000. The number of wage earners was 5,031, receiving annually $4,431,000. Statistics compiled by Bradstreets, for 1903, showed a total of 1,007 business establishments with capital invested of about $12,000,000; wage earners 9,686, receiving annually $7,860,500. The cost of material used in manufactures in 1909 was $10,243,000; and the value of the manufactured product was $18,880,000. Some of the different industrial establishments are lumber mills, manufacturing different kinds of lumber products, sewer and water pipe works, flour mills, flour mill machinery works, brick and terra cotta works, foundries, vinegar and pickle works, machine shops, iron works, cereal food plant, pottery, mattress and furniture factories. Other manufactures are jewelry, tobacco products, gloves, clothing, brooms, trunks, wooden and tin ware, dairy products, packed and canned meats. A large part of the industrial prosperity is owing to the mines in the vicinity, the great agricultural and horticultural resources of the surrounding territory, extensive stock raising, and to the vast water power which offers special inducements to manufactures. This power is made available by the generation of electricity. Water power is furnished manufacturers at $10 per horse power per annum, and electric power on the Niagara scale. Spokane is also the centre of a rich lumbering region. The city is surrounded on the north, east, and south by the greatest area of pine timber forests extant in the United States. The city has grain elevators, an electric light plant, and artificial gas plant, and large lumber yards. The output of the flour mills annually is about 500,000 barrels. A large part of this product was sent to China and Japan.

Commerce and Transportation.—Spokane is the commercial as well as the industrial centre of Eastern Washington and Northern Idaho. Spokane ships to the markets of the world the fine wheat from the interior basin of the Columbia River, the vegetables, deciduous fruits, berries, and the products in general from a region of fertile soil, and the semi-arid districts of the Spokane, Yakima and Wenatchee valleys, made productive by irrigation. Crop failures in this region, popularly known as the "Inland Empire," have never been known. Statistics carefully compiled by the Spokane Chamber of Commerce show the yearly output of this fruitful region for shipment alone to be as follows: wheat, 30,000,000 bushels; fruits and vegetables, 10,000 car loads; $7,000,000 worth of dairy products; 20,000 car loads of live stock; other farm products to the total value of $12,760,000. There is produced annually in this section in gold, silver, lead, and copper, $21,000,000; 225 car loads of refined sugar, and 1,500,000,000 feet of lumber, equal to 75,000 car loads of 20,000 feet to the car, or a solid train 700 miles long. The greater part of the lumber output finds a ready market in the Eastern States and Middle West.

Digitized by Google

SPOKANE.



1. View of Middle Falls and Manufacturing District.
2. Lower Falls of the Spokane River.

Digitized by Google

Digitized by Google

Photograph by William H. Rau.

A BUSINESS STREET OF SPOKANE.

Digitized by Google

The railroads have hardly kept pace with the needs made by the products of lumber camp, farm, mine, and manufactory; but Spokane's facilities for transportation are excellent and increasing. The city, in 1903, had 12 lines of railroad radiating to every point of the compass, and is the greatest railroad centre of the Pacific Northwest. The names of some of the trunk lines have been mentioned. Spokane being a sub-port of entry, has a bonded warehouse and the privileges of the Immediate Transportation Act.

Public Interests.—Spokane is finely situated at an elevation of 1,900 feet above sea level and covers an area of 20.25 square miles. The Spokane River flows through the centre of the city from east to west in a series of cascades, having a total fall of 132 feet. The broad streets of the business portion are paved with asphalt and vitrified brick, and are near the river. The high ground is the residential section, and the views from the hills are most beautiful. The region surrounding the city is picturesque, embracing lofty mountain peaks, whose slopes are covered with dense evergreen forests, broad valleys and numerous lakes, which add much to the attractiveness of the city. Two electric railway systems, with a total of 52 miles of electric road in operation, afford excellent transportation facilities. The city also has 40 miles of suburban electric road, reaching the nearby mountain lakes. Several magnificent public parks add to the city's conveniences. The water and drainage systems are unsurpassed, making the city clean and healthful; the yearly death rate is 10.4 per thousand population. Some of the principal buildings are the government building, city hall, county court-house, Gonzaga College, high school, Auditorium, Review, and Empire State buildings, Masonic Temple, Spokane Club building, Club and Lodge building of the Benevolent and Protective Order of Elks, Spokane Amateur Athletic Club building, Protestant Episcopal, and Roman Catholic Cathedrals, and the churches and the schools. Fort Wright, a United States military post, is located on a tract of land, 1,022 acres, which the city gave to the government in 1894–5, on condition that a large military post should be established and maintained here. Government headquarters of the postal inspection service, known as the Spokane Division, are located here; this division includes the States of Montana, Idaho, Oregon, and Washington, and the territory of Alaska. The city is especially noted for its fine residences and paved streets, and is known throughout the Pacific Northwest as the «Home of the Mining Kings.»

Charities.— The poor and needy of the city are well cared for by several good institutions, as the Home of the Friendless, Saint Luke's and Sacred Heart Hospitals, Crittenden Mission, Saint Joseph's Orphanage, and the Deaconess Home. There are a number of private organizations, as aid societies and auxiliaries.

Education.— The chief educational institutions are: Gonzaga College (R. C.), Academy of the Holy Names (R. C.), Brunot Hall, Seminary for Girls (P. E.), Saint Stephens, and the Lyon School for Boys, a public high school (established in 1889), several private schools, public and parish elementary schools, and a Carnegie public library. There are 22 public school buildings constructed of brick and stone, which are well equipped and will compare favorably with any in the country. Three daily newspapers, with a combined circulation of 30,000; 11 weekly publications; and 12 monthly journals cover the fields of agriculture, mining, and letters.

Banks and Finances.— There are four national banks, which have a combined capital of \$750,000; the bank deposits are \$10,433,446; bank clearances for 1903 were \$112,272,299, which show a gain of 27 per cent over the previous year; five other banking institutions, including a branch of the Bank of Montreal, and several savings banks, mortgage banks, loan and trust companies, and building societies, have an aggregate capital of \$7,500,000. The assessed valuation of city property in 1900 was \$19,500,000; in 1910, \$85,628,822. The net public debt was \$3,470,000. The city owns its waterworks, from which an annual revenue of \$172,000 is derived. The city's total annual income is \$800,000 and total expenditures, including interest on bonds, improvements, etc., \$660,000. The annual expenditures for maintenance and operation are \$300,000; the chief items of which are, for police department, \$31,000; for fire department, \$68,000; for water department, \$17,000; for streets and bridges, \$46,000; for public library, \$8,500. The tax rate for 1910 was \$3 per \$1,000. The school district is separate from the city government. It costs \$250,000 annually to maintain the public schools.

Government.—The municipal government is operated under a city charter. The executive department is operated on the commission plan, there being only five cities in the state, in 1911, so conducted.

History.— The first settlement was made in the summer of 1873. The rapid growth of the city began with the entrance of the Northern Pacific Railroad in 1881. The railroad and adjacent lakes and rivers made the place the distributing centre for the mining and lumbering camps of a large region. On 4 Aug. 1889 the business section was almost wholly destroyed by fire; 35 blocks were included in the burnt section. By 1890 the city had seven railroad lines. The Oregon Railroad & Navigation Company's line had been built, connecting Spokane with Portland, Oregon, and the East. In 1892 the Great Northern Railroad entered the city. The Spokane Falls & Northern to British Columbia, and roads to the mines, forests, and agricultural districts were built as the necessity for means of transportation became apparent in the development of the rich, natural resources of the surrounding country. The growth of the city has been steady and rapid, having thrice doubled in population, as shown by the Federal census; but the increase has not been more than a development of the rich resources of the surrounding region would warrant. Census population (1880), 350; (1890), 19,992; (1900), 36,848; (1910) 104,402.

L. G. Monroe,
Secretary Spokane Chamber of Commerce.

Spondias, a genus of tropical trees belonging to the family of *Anacardiaceæ*, several of which are cultivated for their plum-like yellow fruit (drupes). The leaves are alternate and odd-pinnate, with numerous leaflets. The flow-

Digitized by Google

ers are small, polygamous, in spreading terminal panicles, and 4 to 5 expanded petals. The leaves and bark have therapeutic value. The fruits of various species are known as hog-plums; they are laxative, and often austere in flavor. *Spondias dulcis,* the pomme de cytheie, sweet Otaheite apple or wi-fruit, is the golden-yellow fruit of a tree about 50 feet high, common in Polynesia. This fruit has an apple-odor, but a sharp flavor resembling that of a pineapple, and stringy flesh. The Jamaica plum, or golden apple, is another tall tree, with an ash-like aspect (*S. lutea*), with yellowish flower buds which are made into conserve, and an oval drupe. The Spanish plum is the purplish or yellow fruit of *S. purpurea,* widely cultivated in the West Indies. *S. mangifera,* of India, has smooth fruits called wild mango or amra, which is cooked and made into curries, etc.; the tree also yields therapeutical remedies, and a gum resembling gum arabic, and known as hog-gum. The Brazilian *S. tuberosa* not only has a fruit employed in that country as a febrifuge, but is said to produce aerial roots, that, upon touching the soil, form black hollow cellular tubers, containing about a pint of water, which, although intended as a reservoir for the tree in dry weather, serves travelers also.

Sponge, the horny skeleton, formed of keratose, or spongin, produced by certain animals living in the sea and of very low grade in the scale of life. Down to a quite recent period they were classified as colonial *Protozoa,* the lowest group of animals; but all naturalists now treat them as a separate phylum under the name *Porifera* (or *Spongiaria*), given to them because of the water-pores with which they are provided in such abundance. These pores are ordinarily and chiefly of two kinds, both opening into the internal or digestive canals and passages which everywhere ramify through the mass of the sponge. There are large openings (oscula) relatively few in number, often guarded by special protective devices such as circles of spicules or muscles capable of contracting the orifice, and much more numerous small pores everywhere perforating the surface. The latter are inhalent pores or inlets, which admit water to the internal passages, from which it escapes through the former. A constant current is induced by the activity of countless flagella or little living lashes, generally confined to definite enlargements of the canals known as ciliated chambers which constantly beat the water and drive it ever onward in one direction. This current is a veritable life-giving one to the sponge, bearing into the digestive cavities not only the minute organisms upon which the sponge animal feeds, but also supplying oxygen for respiration, bearing away all waste and excreted substances and assisting in the fertilization of the eggs and the distribution of the larvæ. Some of the simplest sponges, such as are found among those with calcareous skeletons, have but a single osculum at the summit of a sac-shaped or cylindrical body, the walls of which are perforated by many radiating canals, each opening to the exterior by an inhalent pore and ending internally in the central digestive chamber. The walls of such a sponge are composed of the sponge-flesh, formerly called sarcode, together with the skeleton secreted by certain cells of the latter. The flesh consists of three chiefly cellular layers, ectoderm, mesoderm and endoderm. The ectoderm is the sponge-skin and, in the form of a layer of flat cells, covers the whole exterior and lines certain spaces or chambers which are formed in many sponges by a process of infolding. The endoderm lines all of the truly internal chambers and passages, and consists partly of flattened digestive cells which line the central cavity and parts of the radial canals, and partly of cells which bear each a flagellum with a collar surrounding its base on their free ends, and which are confined to the ciliated chambers. These latter collared and flagellated cells are very characteristic of sponges and are found elsewhere only among the *Protozoa.* Between these limiting layers the mesoderm makes up the great bulk of the sponge-body and consists of a variety of different kinds of cells, of which the most important are the reproductive, from which the eggs and spermatozoa are produced; and the skeletogenous, which secrete the elements of the skeleton.

The great majority of sponges are originally of much the form just described, which may be considered as exemplifying the sponge individual; but as they grow they bud and branch in a very plant-like manner, forming many new oscula and many new partial individuals which often reunite and enclose cavities lined with ectoderm. In this manner colonies of large size and most varied forms are built up, and, simple as the fundamental sponge plan is, there are few animals which present more complex structures and whose morphology has been so late in being correctly explained. The skeletons of sponges may be calcareous or silicious or horny, or the latter may be combined with either of the others. The first two may exist in the form of separate spicules, presenting the most varied shapes characterizing the different genera and species, or built up into a more or less continuous frame-work. Horny or spongin skeletons consist of fibres, almost always interlacing, branching and uniting in a most complete and complex manner, and sometimes strengthened by included silicious or calcareous spicules or granules.

Sponges reproduce asexually by a mode of budding and growth similar to that just described or, as especially exemplified in the fresh-water sponges, by the formation of gemmules which are complexly formed buds protected by a spicule-sheath and capable of developing into a complete sponge colony. They also reproduce sexually by the union of ovum and spermatozoön which develops into a free-swimming ciliated larva (planula), serving not only to reproduce the species but through its activity to distribute these fixed and stationary animals. Except a few small fresh-water species all of the sponges are marine, and occupy all seas from the shores to great depths. It is in tropical and subtropical regions, however, that they are especially prominent. Remains of fossil sponges in great number and variety, some of them representing extinct types, occur in all geological formations from the Cambrian upward.

The phylum *Porifera* has been classified as follows:

Class I. *Calcarea,* including sponges with calcareous spicules, such as the little *Grantia ciliata,* so common on the New England coast.

Digitized by Google

Class II. *Hexactinellida,* including sponges with silicious usually six-rayed spicules, such as glass sponges and the beautiful Venus' flower-basket (*Euplectella*) of the Japanese and Philippine seas.

Class III. *Desmospongiæ,* including all other sponges with horny or silicious skeletons, and divided into the following three grades: (1) *Tetraxonida,* with tetraxial silicious spicules; (2) *Monaxonida,* with uniaxial spicules, including the fresh-water sponges. (3) *Keratosa,* with a skeleton of spongin fibres, including all of the commercial and related sponges.

The sponges of commerce come from the eastern Mediterranean Sea, the West Indies, and the coasts of Florida and Central America. In the Grecian Archipelago, Crete, Cyprus, on the coasts of Asia Minor, Syria, Barbary, and the Bahama Islands, sponge fisheries constitute a very important industry. The finest sponges are obtained in Turkish waters. The fishing season commences in May and closes in September or October. Diving is practised, and is carried on in a rude, primitive manner. The diver, who has no dress, seizes hold of a large stone, to which a line is attached, and sinks by means of it to a depth varying from 30 to 180 feet. Keeping hold of the rope, he tears the sponges off the rocks within his reach, and places them in a net; when he has secured a netful he signals by means of the rope to be drawn up.

Modern diving dresses have been introduced successfully in some places. The West Indian trade is annually increasing, and the fishing industry gives employment to 500 boats and over 2,000 persons. The Bahamas and the coast of Florida are the best fishing grounds.

Florida is the only State in the Union which has a sponge-fishery, and there it is confined to the southwestern part of the coast, along the reefs, and to the extensive rocky shoals that lie between St. Mark's and Anclote Keys. The former is known as the Key ground, with its centre at Key West, the latter as the bay ground with its centre at Tampa Bay.

Nearly all of the sponges used in the United States were brought from the Mediterranean till 1852, when attention was called to the immense numbers that were growing in Florida waters. As soon as it was found that the quality of these compared favorably with those of Europe the merchants and fitters-out of vessels of Key West engaged very actively in the business of placing them on the market. At first the best qualities were bought from the fishermen at the rate of 10 cents per pound. As Mediterranean sponges became scarce and costly the Florida sponges cames into more and more demand, and their value increased, proportionately. After about 18 years' fishing on the known ground the supply began to fail. Then, in 1870, a new area of ground, larger than the old one, was discovered, and this gave a new impetus to the trade. In that year Appalachicola sent out a small fleet of sponge vessels which has since been largely increased, and the industry has been energetically pursued with good results.

The methods employed in the fishery differ greatly from those employed in the Mediterranean. Small vessels, carrying crews of from 5 to 15 men, are fitted out for trips of from four to eight weeks on the sponge grounds. The crews are paired off into small rowboats, or "dingies," to catch the sponges. One man stands in the stern, sculling the boat, while the other kneels in the bottom amidship, leaning over the side, and scans the bottom of the sea by the aid of a water-glass. When a sponge is sighted the boat is stopped, and the kneeling man uses a three-pronged hook, attached to a slender pole 30 to 50 feet in length, to secure it. Considerable dexterity is required of both men. To cure the sponges they are first spread about the vessel's deck in their natural upright position, so that they will die, and while decomposing allow the softened animal matter to run off freely. When they have been several days in this position they are taken to the shore and thrown into the water in little pens, called "kraals" (corrals) where the remaining substance is soaked and squeezed out, after which the sponges are removed at intervals and beaten with a stick to facilitate the process.

Although most actively prosecuted during the summer, sponge fishing is now followed more or less throughout the year, the vessels beginning their trips in January and working the different beds successively from north southward. The state of the weather greatly affects the result of the fishery. In some years it has been a complete failure, while in others it has been very profitable, always owing to the weather. As the natural beds of sponges have become scarcer prices have advanced, so that even if a vessel does not secure as large a quantity in a given time as formerly the financial result is about the same.

Several varieties of sponges are caught in Florida waters. There are first, sheep's wool, which sell for $2 to $5 a pound; second, yellow sponges, which sell for 50 to 60 cents per pound, and third, grass sponges, which are coarse in texture and not durable, and sell for 15 to 25 cents per pound. Other coarse grades are boat and glove sponges. When these are marketed they are trimmed and cleaned of sand and shells, and then pressed into small bales of 100 to 120 pounds each, in which form they go to the wholesale dealers. The yellow sponge especially is subjected to a bleaching process to improve the color, but the process ordinarily employed greatly weakens the fibre.

Owing to the rapidly decreasing supply of the finer grades and the rising price the problem of propagating sponges artificially has been taken up seriously by the United States Bureau of Fisheries. It has been found that sponges may be raised successfully both from the egg and from cuttings but, owing to the much shorter time required for the latter to reach a marketable size, the first method has been abandoned. The technical problems of sponge raising have been largely solved and there is every promise that their culture on a commercial scale can be undertaken in the near future, and that the depleted grounds will be restocked.

In 1900 the Florida sponge fisheries employed 2,245 persons, with 156 vessels and other apparatus valued at $594,598. The product aggregated 418,125 pounds of all kinds of commercial sponges, which sold for $567,685. To this total sheep's-wool sponges contributed 181,311 pounds, valued at $483,263.

Digitized by Google

Consult: Lendenfeld, 'Monograph of the Horny Sponges' (London 1889); Haeckel, 'Die Kalkschwämme' (Berlin 1872); Potts, 'Fresh-water Sponges' (Philadelphia 1887); Minchin, in Lankester's 'Treatise on Zoology' Pt. II. (London 1900); Cobb, 'The Sponge Fishery of Florida in 1900,' Rep. U. S. Fish Com., 1903; Moore, 'Reports on Sponge Culture,' 1903; Wilson, 'Sponges of Porto Rico,' Bull. U. S. Fish Com., 1900; Rathbun, 'Fisheries Industries of the U. S.' (Washington 1884).

J. PERCY MOORE,
University of Pennsylvania.

Sponge-cucumber. See FIBRE.

Spon'sors, those persons who at the solemn administration of baptism make profession of Christian faith on behalf of the baptized: the sponsors are also called godfathers and godmothers of the neophyte; and as the sponsors are regarded as having contracted a spiritual relationship among themselves and with their godchild, they used also to be called god-sips (gossips). Sponsors assist at the baptism of adults as well as of infants; but in the baptism of adults those to be baptized, not the sponsors, make answer to the questions put by the minister of the sacrament, «Dost thou renounce the devil and all his works,» etc. By a decree of the Council of Trent two sponsors at most are permitted, a male and a female. In the Anglican Book of Common Prayer it is prescribed that for every male child to be baptized two godfathers and one godmother shall assist, and for every female child one godfather and two godmothers: the same rule applies in the baptism of adults.

Spontaneous Combustion. See COMBUSTION, SPONTANEOUS.

Spontaneous Generation, the doctrine that living matter may originate spontaneously, that is, out of non-living matter. The sudden appearance of living things in dead bodies, as of maggots in flesh, and mold on vegetables, was formerly accounted for by regarding them as the direct products of the decay or putrefaction in which they occurred, through some unexplained process. The Italian experimenter Spallanzani (q.v.) first indicated the probability of the source of these growths being living things or their germs pre-existing in the atmosphere. He found that when he bound organic solutions, as beef-broth or an infusion or «tea» of hay in a vessel closed against the admission of air, no appearance of living beings, or any evidence of «generation» followed; and the same freedom continued when the air which entered vessels containing fermentable solutions was made to pass first through sulphuric acid, through red-hot tubes, and through cotton-wool. That the air does actually contain large quantities of minute organic bodies was demonstrated by Tyndall in his efforts to obtain optically pure atmosphere, and this explains why preserved meats keep for any number of years if properly closed, since, after their thorough cooking, the apertures are hermetically sealed while steam is still escaping, the entrance of atmospheric air with its contents being thus prevented. Lister's antiseptic treatment in surgery is based on the same hypothesis.

But while spontaneous generation is untenable as an explanation of phenomena now in progress, we know nothing of the original development of living things. Evolution is incomplete as a scheme of the universe without the hypothesis of spontaneous origin of living things from inorganic matter. This is a matter in which chemistry must be consulted as well as biology; and the opinions of thinkers in respect to it — in general an attitude of waiting for more light — may be found under such heads as ANIMAL; ANTISEPTIC; BACTERIA; EVOLUTION; LIFE; PROTOZOA.

Spontini, spŏn-tē'nē, **Gasparo** («LUIGI PACIFICO»), Italian composer: b. Majolatti, Italy, 14 Nov. 1774; d. there 24 Nov. 1851. He was educated at the Conservatorio della Pietà d'Turchini at Naples, and at 17 produced his first opera, 'Puntigli delle donne,' which met with immediate success. He went to Paris in 1803, was appointed musical director to the Empress Josephine in 1807, and in 1810 became director of the Italian Opera. In 1820 he accepted the position of court composer and general musical director at the court of Prussia, and entered upon a brilliant career at Berlin. His intense jealousy of Weber aroused popular feeling against him in the latter years of his sojourn in that city and in 1841 he was removed from office though retaining both title and salary. He had been elected one of the five members of the Academie des Beaux Arts at Paris in 1839, and in 1842 he returned to that city. His operas met with continued and brilliant success and he is generally considered the greatest composer in French tragic opera between Gluck and Meyerbeer. His operas include: 'L'eroismo ridicolo' (1797); 'La vestale' (1807); 'Nurmahal' (1822); 'Alcidor' (1825); 'Agnes von Hohenstaufen' (1829); etc.

Spool, a cylinder usually hollow, on which thread is wound; also the spool or bobbin for winding machines. The cost of making spools is a most important item in the thread-manufacturing trade. They have been made of wood, in one or more pieces, but recently a process has been invented for making them out of pulp.

Spoonbill, a wading-bird of the family *Plataleidæ,* closely related to the ibises, from which the group differs principally in its straight grooved bill, which is quaintly flattened and expanded at the end. The three genera, *Platalea, Ajaja* and *Platibis,* comprise about eight species found in all warm countries. The only American species is the roseate spoonbill (*Ajaja ajaja*). At present it is found throughout South America and northward into the South Atlantic and Gulf States, but formerly ranged to Virginia and Illinois. The general form is heron-like but stouter; the length somewhat less than three feet, the wing expanse about 4½ feet; the color is white tinted with rose, which becomes quite deep on the under parts, with rusty yellow patches on the tail and sides. The head is bald and variegated with black, green, yellow and orange colors; the bill similarly colored with the addition of blue; the legs and iris red. Young birds lack the rosy tints and have the head fully feathered. This singular and brilliant bird lives gregariously in wooded swamps; and is still abundant in parts of South America and the more inaccessible parts of Florida, but has been exterminated in many places where it was formerly plentiful. They wade in the water and

Digitized by Google

sweep their bills sideways through the mud in search of fishes, frogs, crustaceans, mollusks, insects and worms, upon which they feed. They are strong but heavy in flight, and are able to swim somewhat. Besides their harsh cry they produce a clattering noise by snapping the bill like storks. Nesting takes place in colonies, the nest being constructed of twigs in trees and bushes. The three white, rough, elliptical eggs, more than 2½ inches in length, are laid in April. The European spoonbill (*Platalea leucorodia*) is widely distributed throughout southern Eurasia, but formerly bred in England. Except that the head is crested and the color chiefly white it closely resembles our species in appearance and habits.

The name spoonbill is also given to a duck (see SHOVELER); and to a sandpiper (q.v.).

Spoon'er, John Coit, American legislator: b. Lawrenceburg, Ind., 6 Jan. 1843. He removed with his parents to Madison, Wis., in 1859, was graduated from the University of Wisconsin in 1864, and then enlisted as a private in the Union army. He was mustered out of service as brevet-major, and in 1870 established himself in a law practice at Hudson, Wis. He was elected to the State legislature in 1872, served in the United States Senate in 1885–91, and again from 1897–1907, resigning in the latter year.

Sporades, spŏr'a-dēz, Greece, the most southerly group in the Ægean Sea, comprising 19 islands lying directly east of the Cyclades, whose antithesis they are — being somewhat scattered — whence the name. The principal islands are: Scio, or Chios, Samos, Cos, Rhodes, Lesbos, and Patmos (qq.v.).

Sporob'olus. See GRASSES IN THE UNITED STATES.

Sporog'ony, a form of reproduction by Spores. See SPOROZOA.

Sporozoa are protozoans which in the adult condition are without flagella or cilia, contractile vacuole and opening for the ingestion of solid food. The class embraces only exclusively parasitic forms, which at some point in their life-cycle produce numerous descendants that are denominated "spores," and are usually covered by a firm shell. These spores may be single or manifold, and in special cases the cyst wall may be lacking. The young forms always start the life-cycle as cell-parasites and in all but rare cases alternation of generations appears in the course of the life-history, an asexual type of reproduction (schizogony) alternating with a sexual (sporogony). In most cases also these phases in the life-cycle are found in different hosts. The class was made by Leuckart in 1879 when he brought together the gregarines (Gregarinida), the psorosperm sacs of Müller (Myxosporidia), the oval or spherical psorosperms of Eimer (Coccidia), and Rainey's or Miescher's corpuscles (Sarcosporidia); later investigators have added the Microsporidia, Amœbosporidia, and Hæmosporidia.

The complications which have arisen in the asexual mode of reproduction are great, and a knowledge of the sexual generation is usually necessary for the identification of a species, while upon its character also the major subdivisions of the class are founded. Thus in the Coccidiomorpha the asexual stage is permanently intracellular, while the sexual is so only transiently, and the fertilization takes place between gametes of different form. The Gregarinida, on the other hand, are intracellular at the start of the asexual stage only, and the adult is extracellular as well as the sexual generation, while the gametes are similar.

The Coccidia occur as parasites of epithelial cells, particularly in the alimentary canal and its adnexa; they are spherical or elliptical and without differentiation of ectoplasm and endoplasm. The organism grows at the expense of the host-cell until the latter degenerates to a mere empty membrane encircling the parasite. The parasite now gradually divides into a nest of crescentic spores surrounding a central residual mass. These spores break out, infect new cells and repeat the process. In response to some condition, perhaps excessive infection of the host, the spores develop in forms of two types, the macrogamete and microgametocyte. On the latter are formed microgametes, one of which unites with a macrogamete and the resulting oocyst or copula is the starting-point of the sexual period of the life-cycle, known as sporogony. In most Coccidia this takes place outside the host and consists in the formation of a small number of sporoblasts, each of which produces a firm membrane, becomes thus a sporocyst and its contents divide into a few sporozoites. The latter are the infecting agents and start anew the asexual cycle. The Coccidia parasitize almost all groups of animals; several have been reported occasionally from man, and these with others occur in various animals as the cause often of serious epidemics.

The *Hæmosporidia* pass the asexual cycle of the life-history in the red blood-corpuscles and are the cause of various malarial fevers in man and other animals. The sexual cycle takes place in another host which is regularly a blood-sucking insect. The life-history of the parasite of human malarial fever may serve to illustrate conditions in this group. The parasite first appears as a minute object in the red corpuscles; it grows rapidly, and ultimately divides into a group of young germs which, with a small mass of residual matter, are set free into the blood plasma by the destruction of the corpuscle. The synchronous release of multitudes of such germs produces the chill characteristic of the disease. These germs infect new corpuscles and continue the cycle until ultimately some such grow into forms which introduce the sexual generation with macrogametes and microgametocytes. These forms await ingestion by a mosquito in the stomach of which microgametes are produced and copulate. The copula penetrates the stomach wall where there are formed from it myriads of sporozoites that wander into the salivary gland and are injected into a new human host when the mosquito bites, thus beginning again the asexual cycle.

The germs of human malaria are transmitted only by mosquitoes (q.v.) of the genus *Anopheles;* there are, however, at least three species of such malarial germs, giving rise to the three distinct types of malarial fevers known as tertian, quartan and pernicious. Protection from the bite of the mosquito or the destruction of all mosquitoes in a given region will prevent the occurrence of new cases of this disease and ultimately eradicate it as well as elephantiasis,

Digitized by Google

yellow fevor and any other diseases transmitted by mosquitoes. In the list of such maladies have been placed dengue, leprosy and tuberculosis, as well as those mentioned above; but the relations of these diseases and the infecting agent have been much less definitely determined than in the three first noted, where the demonstration is positive. See MOSQUITO.

Other disease-producing hæmatozoa, of which the life-history and consequently the relationships are only imperfectly known, but which are probably allied to the group under consideration, are the parasite of the spotted or tick-fever of the Rocky Mountains, presumably transmitted by ticks, the parasites of yellow fever and dengue transmitted by mosquitoes, and the parasite of smallpox. Probably the most widely known disease among animals, due to organisms of this group, is Texas fever in cattle, which is transmitted by cattle-ticks. (See RINDERPEST.) Prominent diseases among fishes are produced by the Myxosporidia, also included among the Sporozoa. No doubt other forms which will have to be included here will be discovered to be the cause of other diseases in man as well as other animals, although some reports of supposed discoveries in the past have been shown to be in error, and the theory of the parasitic origin of cancer and other malignant growths still awaits demonstration.

Chief works on Sporozoa: Doflein, F., 'Die Protozoen als Krankheitserreger' (Jena 1901); Lühe, M., 'Ergebnisse der neueren Sporozoenforschung' (Jena 1900; very valuable full bibliography); Wasielewski, von, 'Sporozoenkunde' (Jena 1896); Calkins, G. N., 'The Protozoa' (New York 1901; brief chapter, but good bibliography); Labbé, A., 'Sporozoa' in 'Das Tierreich' (Berlin 1899; purely systematic).

HENRY B. WARD,
University of Nebraska.

Spor'ran, a pouch or large purse worn by the Highlanders of Scotland in full dress, and by men of the kilted regiments. It is usually made of the skin of some animal, and often ornamented with silver and stones. It is worn in front of the kilt.

Sporting Records. See SPEED.

Sports, The Book of, a popular name for the proclamation issued in 1618 by James I., and ordered to be read in all churches, wherein it was declared that dancing, archery, May-games, morrice-dances, leaping, vaulting, and other such games, were lawful on Sunday after divine service, but prohibiting bear-baiting, bull-baiting, bowling, and interludes. The order to read this declaration was largely disregarded, but in the reign of Charles I. it was republished (1633) and enforced with severity. This created great outcry and opposition, and in 1644 the Long Parliament ordered all copies of it to be collected and publicly burned.

Sports in Plants, a term in biology denoting an individual which differs more or less markedly from the type or parent species; an aberrant form. It is distinguished from «monstrosity» by its ability to transmit its aberrant character either sexually or asexually to offspring; whereas monstrosities properly so called lack this power, their offspring if any, reverting to the general type. The origin of sports has furnished much food for speculation, some biologists assuming that aberrations are freaks which nature destroys, while others declare that the transmutation of species is dependent upon them through the processes of natural selection of the adaptive ones. If the term is to be used as an approximate synonym of monstrosity the first hypothesis is probably true; but if used in its broadest sense the latter is more nearly correct. The matter hinges mainly upon the extent of observation; for, while sports among undomesticated animals are comparatively rare, they are numerous among uncultivated plants, but have been commonly overlooked because biologists have been more awake to the animal than the plant. Each leaf-bud of a plant is capable of producing leaves and branches which differ from those produced by any other bud, and every flower-bud may produce a flower unlike any of its fellows; nay, further, the individual seeds which follow any flower in a single fruit may produce plants unlike one another in many respects and also unlike the parent. But unless these departures are striking enough to attract the attention of the ordinary observer as distinct they are unnoted and hence not calculated upon; hence the popular opinion that sports appear «suddenly,» since only the remarkable cases are observed.

There can be no doubt that sports result from unusual or complex stimuli or unaccountable refrangibility of vegetative force, and for these reasons may be, usually are, unstable when normal conditions are again operative. However, this does not oppose but it rather enforces the statement that sports result from the same causes as underlie all variation in the plant kingdom, bud-variation being one of the most important and significant phenomena of plant-life. But though the causes are usually unknown in plants and vertebrate animals, sports have been produced artificially with diverse lepidopterous insects by varying the humidity, dryness and temperature of the air during the process of growth or pupation. The crossing of the sports with the type-species does not usually result in an intermediate form but in two main groups, in one of which the offspring resemble the male parent and in the other the female.

From a practical standpoint, selection and breeding of sports has long been widely employed. Among domestic animals one of the most striking instances is that of Ancon or otter sheep, the ancestor of which was a long-bodied, crooked-legged freak which was bred to sheep of normal character. Only the individuals which resembled the aberrant parent were used for subsequent breeding. With domesticated plants the practice of breeding from the sports is still more striking, because it can be practised either sexually or asexually. The initial sport may appear as a seedling or as a «bud-variation.» In the former case the gardener usually propagates by means of seed, rigorously discarding all specimens that depart unfavorably from the apparent intent of the primal sport, and carefully saving those specimens that approximate or accentuate the characters. If the sport is a bud-variation the gardener usually propagates it by means of cuttings, practising a careful suppression of individuals which seem to retrogress and selecting desirable ones

Digitized by Google

for further propagation, as in the former case. It may seem expedient to practise asexual methods with a plant produced sexually or *vice versa;* in each case, however, the after-selection is imperative. Some bud-varieties fail to "come true" even from cuttings, and failure in this respect is common among seed sports. Bud-variation and seed-variation are the same kind since the same means of improvement can be used in each case.

Far from being comparatively rare, sports are very common among cultivated plants, almost every species of importance furnishing instances. Among well known bud-sports: the purple or copper beech, purple-leaved plums, and many weeping, variegated, and cut-leaved trees and shrubs, are familiar examples. The *perle des jardins* rose has given rise to several commercially important bud-varieties. The moss-roses are bud-sports. The "mixing" of potatoes in the hill is also well known. Among plants propagated by seeds instances are legion — tomatoes, cabbage, corn, parsley, onions, and a host of garden flowers. Probably the most striking instance of a plant producing both bud-sports and seed-sports of value is the peach. Occasionally a seed will produce a smooth-skinned fruit popularly called a nectarine, which in turn may produce either a nectarine or a peach. Certain branches of the peach tree may produce nectarines and *vice versa.* Russet apples are sometimes seen upon greening trees. The sports may occur in any part of the parent plant — roots, tubers, rhizomes, stems, flowers, leaves, seeds, and even buds upon the stem or the roots.

Another practical application of the tendency to sport among plants is the grafting of fruit trees with scions taken from the "bearing wood" of specially prolific or precocious trees of any particular variety. Such scions usually commence to bear earlier, or produce more regularly, or both, than scions taken from shaded portions of the same parent trees or from unproductive individuals.

One of the common troubles with sports is self-sterility. This is scarcely important except with fruit trees where, if large blocks of one kind of tree are planted remote from other varieties that blossom at the same time little or no fruit will be set. See paragraph *Varieties* under title APPLE.

Sports are to be distinguished from reversions in which the individual seems to hark back to the general form of its more or less distant ancestors. They must also be separated from cases of atavism (q.v.) in which the progeny exhibit a character not typical of their race, species or genus but characteristic of an allied ancestral race. Instances of reversion (q.v.) are the loss of the bulbous root of turnips and the "head" of cabbage which "run wild"; of atavism, the occasional appearance of several toed horses, whose feet somewhat resemble the three-toed foot of the horse of Tertiary time. See BREEDING; BUD; HEREDITY; HYBRIDITY; NATURAL SELECTION; VARIATION; and consult the authorities cited under them.

Spot, a fish. See GOODY.

Spotswood, spŏts'wŭd, **Alexander,** American colonial governor: b. Tangier, Africa, 1676; d. Annapolis, Md., 7 June 1740. He entered the English army in early youth, fought at the battle of Blenheim, was deputy quartermaster-general under the Duke of Marlborough, and in 1710 was appointed governor of Virginia. His administration was one of great benefit to the colony, he was the bearer of the writ of habeas corpus, a fact which gained for him the favorable attention of the colony, and his popularity was for a long time unbroken. He greatly assisted the William and Mary College, concluded a treaty with the Six Nations in 1722 which secured for the colonists the territory east of the Blue Ridge, south of the Potomac, and originated the act to make tobacco notes a medium of purchase, introduced various beneficial measures into the colony. His aim was invariably the good of the colony, but his haughtiness won for him in time enemies, and the controversy which arose over church patronage, which he held to be a privilege of his office, enabled his opponents to gain his removal from office in 1722. He continued his residence in Virginia, served as deputy postmaster-general in 1730–9, and greatly improved mail facilities. He fostered the iron industry, endeavored to promote vine-culture, and otherwise evinced an undiminished interest in the colony. In 1740 he was appointed major-general to command an expedition to the West Indies, but died just previous to embarking. His letters were purchased by the Virginia Historical Society in 1882 and published in their collection as 'The Official Letters of Alexander Spotswood, Lieutenant-Governor of Virginia in 1710–1722' (1882–5).

Spotswood, or **Spotiswood,** spŏt'ĭs-wŭd, **John,** Scottish ecclesiastic: b. in the parish of Mid-Calder, Midlothian, 1565; d. London 26 Nov. 1639. He studied at the University of Glasgow, and at 18 became assistant to his father as parson of Calder. At the outset he supported the Presbyterian party, but in 1601, when the Earl of Lennox was sent as ambassador to France, Spotswood accompanied him as chaplain and "made no scruple to go in to mass." On his return he was complained of to the General Assembly, but through the influence of the court escaped with merely a reprimand. He became a favorite at court, and in 1603, when King James set out for England, was one of the five Scottish clergymen selected to accompany him. In the course of the journey news arrived of the death of the Archbishop of Glasgow, and Spotswood was immediately appointed his successor, and in consequence returned to Scotland, but was not consecrated till 1610. In 1615 he exchanged Glasgow for the metropolitan see of Saint Andrews and became primate of Scotland. In 1618 he presided over the General Assembly at Perth, and succeeded in carrying the five points of ecclesiastical discipline known as the Perth Articles. He continued to enjoy royal favor under Charles I., whom he crowned in the Abbey Church of Holyrood in 1633; but by his harsh procedure against Lord Balmerino contributed greatly to inflame the opposition to episcopal government, which now became general among all ranks, and finally led to its overthrow. In 1638, at the Assembly held at Glasgow, he was deposed, excommunicated and declared infamous. He saved himself by flight, and took up his residence in London, where he died. He is the author of a 'History of the Church of Scotland' (1655), commencing at 203 and continued to the end of the reign of James VI.

Digitized by Google

Spotted Fever, cerebro-spinal meningitis. (See MENINGITIS.) Spotted fever is a term also applied to a form of typhus fever (q.v.).

Spotted Sandpiper. See SANDPIPER.

Spottiswoode, spŏt'is-wŭd, **William,** English mathematician and physicist: b. London 11 Jan. 1825; d. 27 June 1883. He was educated at Balliol College, Oxford, and in 1846 became manager of his father's printing establishment, the well known house of Eyre and Spottiswoode. He was the author of 'A Tarantasse Journey through Eastern Russia' (1857); 'Mediatationes Analyticæ' (1847); 'Elementary Theorems relating to Determinants' (1851); 'The Polarization of Light' (1874); etc. He was president of the London Mathematical Society (1870-2), of the British Association (1878), and of the Royal Society (1878). In mathematics he is chiefly distinguished as one of the first to make extensive use of the symmetrical determinant notation, and as the author of a series of papers in the 'Philosophical Transactions' of 1862 and the following years on the contact of curves and surfaces. In physics he devoted himself mainly to the study of polarized light anl electrical discharge through rarefied gases.

Spottsylvania Court House, Battles of. The battle of the Wilderness (q.v.) was fought 5 and 6 May 1864, and a reconnoissance made by Gen. Birney's division down the Orange plank road, on the morning of the 7th, developed the fact that the Confederates had fallen back to their intrenched lines, with pickets to the front, covering a part of the battle-field. "From this," says Gen. Grant, "it was evident to my mind that the two days' fighting had satisfied him (Lee) of his inability to further maintain the contest in the open field, notwithstanding his advantage of position, and that he would await an attack behind his works. I therefore determined to push on and put my whole force between him and Richmond, and orders were at once issued for a movement by his right flank." The first objective was Spottsylvania Court House, 15 miles southeast of the Wilderness field, which, by a night march it was proposed to reach early on the morning of the 8th. As a preliminary to the movement Sheridan's cavalry was to seize Todd's Tavern, on the Brock road, midway between the Wilderness field and Spottsylvania Court House, and hold the place and the roads crossing Po River. This was done on the 7th, the Confederate cavalry being driven from the place, Wade Hampton's division retreating south to Corbin's bridge over the Po, and Fitzhugh Lee's eastward on the Brock road toward the Court House. (See TODD'S TAVERN, ENGAGEMENT AT.) At 3 P.M. the trains began their movement toward Chancellorsville and Piney Grove Church; Warren's Fifth corps started after dark and, marching on the Brock road, along the rear of Hancock's Second corps, arrived at Todd's Tavern at 3 A.M. of the 8th, much impeded and delayed in its march by the mounted provost guard of the army which immediately preceded it; Sedgwick's Sixth corps followed, marching eastward to Chancellorsville, then southward to connect with Warren; and Burnside's Ninth corps followed Sedgwick. Hancock's Second corps did not march until daylight, when it moved to the left on the Brock road to Todd's Tavern, which it reached at 9 A.M. of the 8th, and intrenched. When Warren arrived at Todd's Tavern he found Merritt's cavalry division engaged with that of Fitzhugh Lee. At 6 A.M. Merritt was withdrawn and Robinson's division of Warren's corps took its place and, slowly driving back Lee's cavalry, had reached open ground 1½ miles from the Court House, when from a piece of wood 200 to 300 yards in front it received a heavy musketry and artillery fire, which severely wounded Robinson, and so staggered his division that it fell back to the woods in its rear. Robinson had encountered two brigades of R. H. Anderson's corps, the advance of Lee's army, which had beaten Grant in the race for Spottsylvania Court House. Lee had divined Grant's intention and, on the 7th, had cut a military road through the forest from the Orange plank road to the highway by Shady Grove Church, thence eastward to the Court House; and being informed by Stuart, late in the day, that Grant's trains were in motion southward, that night he gave orders for the movement of his army to the Court House, on roads nearly parallel to the Union line of march, and but a mile from the Brock road. Gen. R. H. Anderson, who commanded Longstreet's corps, had been ordered to move on the morning of the 8th, but being much troubled by the fire and suffocating smoke in the Wilderness woods, concluded to avoid it, set out at 11 P.M. of the 7th and, marching all night, arrived near the Court House at 8 o'clock next morning. There, finding Lee's cavalry engaged with Warren's infantry, he marched part of his corps to Lee's support, and two brigades marched on to the Court House and occupied it, Wilson's cavalry division, that had been sent by Sheridan to seize it, and that had been in possession two hours, withdrawing. Lee's cavalry withdrew as Anderson came up, and Anderson took up the fight with Warren. Griffin's division of Warren's corps, which had advanced on Robinson's right, was repulsed, and both fell back upon Crawford's and Cutler's divisions, which had now reached the front. Cutler advanced and drove the Confederates from Griffin's right, and Warren threw up intrenchments from 200 to 400 yards from those of the enemy. It was now about noon. About 1 P.M. Sedgwick came up, under Meade's order to support Warren in an assault upon the Confederate position, the right of which rested on the Brock road. It was late in the day when the assault was made. Penrose's New Jersey brigade of the Sixth corps charging over open ground was repulsed by the right of Anderson's corps. A little later Crawford's division of Warren's corps went forward, passed the right of Anderson, and struck Rodes' division of Ewell's corps, which was going into position on Anderson's right. Rodes, taken at a disadvantage, was driven back some distance, but rallied and drove Crawford back to his intrenchments. Ewell's entire corps came up during the evening and formed on Anderson's right. The Union loss during the day was about 1,300.

A. P. Hill's corps, under command of Gen. Early, came up on the morning of the 9th, and Lee established his lines covering Spottsylvania Court House, with Anderson's corps on the left, resting on Po River. Ewell's corps in the centre,

Digitized by Google

and Hill's on the right, covering the Fredericksburg road. The line was eight to ten miles long, and the greater part of it ran through woods tangled with undergrowth, or on the edge of them, with slashings and abatis in front. It was everywhere strongly intrenched and well-planted with artillery. During the 9th Lee was employed in rectifying and strengthening this line, and Grant in examining and developing it, and also in readjusting his own lines. Skirmishing was sharp on both sides, and early in the morning Gen. Sedgwick, commanding the Sixth corps, was killed. Gen. Wright succeeded to the command of the corps. Early in the day Burnside moved across from the Plank road to the Fredericksburg road, at the crossing of Ny River, east of the Court House, and threw one of his divisions across the river, which encountered infantry and some dismounted cavalry. Hancock moved east from Todd's Tavern to the right of Warren and intrenched, overlooking Po River. Sheridan cut loose from the army and started from Todd's Tavern on his Richmond raid. Burnside had reported to Grant that in his movement on the 9th he had met the enemy east of the Court House and judged from indications in his front that Lee was meditating a movement north toward Fredericksburg, upon which Grant ordered Hancock to make a movement on the 10th on Lee's left, across the east and west bends of Po River. This movement led to the engagement on Po River (q.v.). While this battle was in progress Warren was engaged in feeling the Confederate lines in his front preparatory to an assault, and Gibbon's division was withdrawn from Hancock and placed on Warren's right and for the time under his orders. At 11 A.M. Gibbon advanced with two brigades, met an obstinate resistance from Fields' division, and was compelled to fall back with much loss. Warren followed with two of his own divisions, with a view to gain ground for the formation of a column of assault, and was repulsed by Fields, but he had gained information of Fields' position which induced him to report to Meade that a general assault would be successful. Hancock had been designated to make the assault at 5 P.M. with the Fifth and Sixth corps and part of his own, but he was engaged at Po River, and at 3.45 P.M. Meade directed Warren to make the assault, which was done with Crawford's and Cutler's divisions of the Fifth corps and Webb's and Carroll's brigades of the Second. The assault fell upon Fields' division and failed, Warren being repulsed with heavy loss, including Gen. Rice killed. Gen. Hancock returned from Po River at 5.30 P.M., just before the close of Warren's assault, and at 7 P.M. made another assault with Birney's and Gibbon's divisions. This assault fell on Geo. T. Anderson's brigade and Greggs' Texas brigade, both of Fields' division. Some of the assaulting troops gained the works held by the Texas brigade and went over them, pushing back the Texans; but a flank fire of Anderson's brigade drove them out and the attack was repulsed, many dead and wounded being left inside the works. The assaulting column fell back in some disorder, the men demoralized by the fruitless work.

At about the same hour Gen. Wright, on the left of Warren, made an assault. He had found what he deemed to be a vulnerable place to a vigorous attack. It was on the west face of the noted salient, held by Rodes' division of Ewell's corps. Upton's brigade of the Sixth corps, reinforced by four regiments of Neills', was to make the assault, supported on the left by Mott's division of the Second corps, which was to assault on its own front at 5 P.M. Upton formed in four lines, and the batteries opened a direct and enfilading fire, which ceased only when Upton charged from the woods, and under a terrible front and flank fire, went over the Confederate works, broke Doles' brigade and part of Daniel's, captured many prisoners, and pushed on to a second line of works upon which he planted his colors, and captured a four-gun battery. He had broken the Confederate line to the length of a division; but Mott had failed in his allotted task of supporting him on the left; and recovering from their surprise and temporary disaster, the Confederates threw two brigades in his front; Daniels', R. D. Johnston's, J. A. Walker's and Steuart's brigades fell upon both flanks; and Upton was ordered to withdraw, which he did under cover of the darkness. He had lost about 1,000 men, many of whom were left dead and wounded inside the Confederate works. He was obliged to abandon the captured battery, but he carried back with him 1,200 prisoners and several stands of colors. Farther to the left Burnside made a reconnoissance toward Spottsylvania Court House, and had a spirited engagement, driving back the enemy close to the Fredericksburg road and intrenching a part of his line, as he reports, within a quarter of a mile of the Court House. In this engagement Gen. Stevenson, one of his division commanders, was killed. During the day of the 10th the Union forces engaged numbered about 38,000; the losses were about 4,200 killed and wounded; but few were missing. The estimated Confederate loss was 2,000 killed and wounded.

On the morning of the 11th Grant reported to Halleck that in the six days' fighting since crossing the Rapidan he had lost 11 general officers and probably 20,000 men; renewed his call for reinforcements, which he hoped would be sent as soon as possible and in great numbers; and assured Halleck that he meant to fight it out on that line if it took all summer. Finding that the Confederate left was so well guarded, he made arrangements to attack the centre at a salient of the line. Gen. Wright was directed to extend his left, concentrate on that wing, and be prepared to co-operate with Hancock in an assault. Hancock, with the Second corps, was to pass to the left of Wright during the night and assault the salient at daylight. Warren's Fifth corps was to assault the works in his front to keep the Confederates in them, and on the extreme left Burnside was to lead the Ninth corps in an assault. The day was very stormy and disagreeable, and no serious fighting took place, though there was heavy skirmishing along the entire line, in which the artillery occasionally took part. Wright extended his lines during the afternoon. The two divisions of Barlow and Birney of Hancock's corps started at 10 P.M., and at midnight reached the Brown House, where they found Mott's division; and passing over the intrenchments, and as near to the picket line of the enemy as possible they began the formation of

Digitized by Google

the column of assault. Barlow's division was formed across a clearing in two lines of masses, each regiment being doubled on the centre. Brooke's and Miles' brigades constituted the first line, and Smyth and Brown the second. Birney's division formed on Barlow's right, in two deployed lines. Mott formed in rear of Birney, and Gibbon's division was placed in reserve. It was nearly daylight when these preparations were completed, and the column formed within 1,200 yards of the Confederate line.

The Battle of the Salient.— The point to be assailed was where Lee's intrenchments had been carried northward to enclose a space about a mile in length and half a mile in width, of the general shape of an acorn: the Confederates called it the «Mule-Shoe.» Taken together, the faces of the salient or «Mule-Shoe» covered about 2¼ miles in length, and were occupied mainly by Ewell's corps, Edward Johnson's division holding the apex or east angle of the works, and Rodes' division the west angle and face. To provide against contingencies, a second line had been laid off and partly constructed some distance in rear, so as to cut off the salient at its base. In rear of this line was Gordon's division as a reserve. On Ewell's right was A. P. Hill's corps; on his left was Longstreet's, commanded by R. H. Anderson. Gen. Lee had detected some movements that indicated a withdrawal from the front of Anderson's corps and, under the impression that Grant had begun another flanking movement, late in the day he ordered the withdrawal of all the artillery in the left and centre, which was difficult of access, that it should be done before it was entirely dark, and that everything should be in readiness to move at any moment. Under this order Ewell's chief of artillery removed all but two batteries from the line of Edward Johnson's division. During the night Johnson discovered that the Union troops were massing in his front; and, convinced that he would be attacked in the morning, he asked Ewell for the immediate return of the artillery. The men in the trenches were on the alert, when at dawn on the morning of the 12th they saw a dense column emerge from the woods half a mile in front of the salient and rush to the attack. Johnson says: «They came on in great disorder, with a narrow front, extending back as far as I could see.» The charging column was Barlow's division, led by the brigades of Brooke and Miles. It had been ordered to make the assault at 4 o'clock, but owing to a heavy fog it was not sufficiently light to enable objects to be clearly discerned until 4.30, when the order to charge was given. Birney, on the right, met difficulty in the rough ground over which he moved, but kept nearly abreast of Barlow's line. When the Confederate works were seen a wild cheer was given; Brooke and Miles tore down the abatis, and in the face of a deadly fire sprang over the intrenchments, and a desperate hand-to-hand encounter ensued; Birney came up on the right; the battalion of Confederate artillery that had been withdrawn came back just in time to have its horses and cannoneers shot down before a gun could be fired; and in a very short time nearly a mile of the works had been carried. Gen. Johnson himself and Gen. Steuart, 20 guns, 30 colors, and nearly 3,000 men were captured. With scarcely a halt Barlow and Birney swept on for nearly half a mile, then thoroughly disorganized, they were brought to a stand before another line of works, held by Gen. J. B. Gordon's division and Lane's brigade of Hill's corps. As Gordon was about to charge, Gen. Lee rode up and joined him, evidently intending to go forward with him. Gordon remonstrated, the men cried, «Gen. Lee to the rear!» and one of them seized the general's bridle and led his horse to the rear, and Gordon's men went forward and attacked the Union lines in rear of the captured works. After a fierce struggle in the pine woods the Union troops, piled in one upon another, six or eight lines deep, were forced back out of the works but held the outer side of them. The Sixth corps, coming up, took post on the right of the Second, occupying the line from the west angle southward; Mott's division joined the Sixth corps at that angle; Birney's division came next on the left; then Gibbon's; then Barlow's. All set at work to turn the captured intrenchments. There was great confusion in the intermingling of commands on a narrow front, and the Confederates now made most determined efforts to recover their intrenchments. Anderson sent troops from the left, three brigades of Hill's corps came from the right, and for the distance of nearly a mile, amid a cold, drenching rain, the combatants engaged in a desperate struggle across the breastworks. Gen. Walker, the historian of the Second corps, says: «They fired directly into each other's faces; bayonet thrusts were given over the intrenchments; men even grappled with their antagonists across the piles of logs and pulled them over, to be stabbed or carried to the rear as prisoners. Gen. Hancock had, as soon as the first success was achieved, brought up some of his guns to within 300 yards of the captured works, and these were now pouring solid shot and shell over the heads of our troops, into the space crowded with the Confederate brigades; he even ran a section of Brown's Rhode Island, and a section of Gibbs' Fifth United States, up to the breastworks; and though the muzzles protruded into the very faces of the charging Confederates, the begrimed cannoneers for a time continued to pour canister into the woods and over the open ground on the west of the McCod house. The contest had settled down to a struggle for the recovery of the apex of the salient between the east and the west angle. . . . Never before since the discovery of gunpowder, had such a mass of lead been hurled into a space so narrow as that which now embraced the scene of combat. Large standing trees were literally cut off and brought to the ground by infantry-fire alone. If any comparison can be made between the sections involved in that desperate contest, the fiercest and deadliest fighting took place at the west angle, ever afterward known as 'The Bloody Angle.' Here Wright's Sixth corps had taken post on coming up at 6 o'clock. . . . All day long the bloody work went on, and still the men of the North and of the South were not gorged with slaughter. The trenches had more than once to be cleared of the dead, to give the living a place to stand. All day long, and even into the night, the battle lasted, for it was not till 12 o'clock, nearly 20 hours

Digitized by Google

after the command 'Forward' had been given to the column at the Brown House, that the firing died down, and the Confederates, relinquishing their purpose to retake the captured works, began in the darkness to construct a new line to cut off the salient." During the day diversions were made on both sides to relieve the tremendous pressure in the centre. On the right of the Sixth corps, Warren, with a part of the Fifth, made an attack upon Anderson's corps and was repulsed with a loss of over 1,000 men. On Hancock's left Burnside's Ninth corps made an assault, and after lodging the head of column of Potter's division inside of Hill's works, it was attacked in flank and driven back with heavy loss. Later in the day Gen. Early, commanding Hill's corps, advanced from his works to strike Burnside in flank, Burnside was met in motion and driven back to his works, and Early returned to his own lines. The Union forces engaged on the 12th numbered about 66,000 men, of whom 6,020 were killed and wounded, and 800 missing. The records do not show the number of Confederates engaged, nor their losses, but it is estimated that their total loss was between 9,000 and 10,000, of whom about 4,000 were captured.

On the morning of the 13th it was ascertained that the Confederates, failing to recover their lost intrenchments, had fallen back, and Col. Carroll, with a brigade of the Second corps, went forward to reconnoiter, found them strongly intrenched on a new line at the base of the salient, and after a sharp engagement withdrew. Dispositions were now made to turn Lee's right flank, and during the night of the 13th the Fifth corps, followed by the Sixth, moved over to the Fredericksburg road. The 14th was occupied in getting the two corps in position. The Confederates were found strongly intrenched on the Fredericksburg road in front of Spottsylvania Court House, and an attack was deemed inexpedient. During the day the Confederates attacked Upton's brigade of the Sixth corps, and compelled it to fall back from an advanced position, but the ground was immediately retaken by a brigade from the Fifth and one from the Sixth corps. When Lee saw that the Fifth corps had moved away from Anderson's front, Anderson's corps was shifted from the left to the extreme right, beyond the Fredericksburg road, and extended the line to Po River. Ewell still held the works in rear of the bloody salient. From the 12th to the 18th Grant was employed in constant reconnoitering and skirmishing, developing Lee's position and ascertaining if he could find a weak point in it; also in establishing a base at Aquia Creek, sending the sick and wounded there, drawing necessary supplies, and awaiting the arrival of reinforcements from Washington to fill his depleted ranks. Early in the morning of the 18th the Second corps, supported by the Sixth corps on the right and Burnside's Ninth corps on the left, Warren assisting with his heavy artillery, made an attempt to force the lines held by Ewell's corps, at the only point where former efforts had met with even partial success. It was a failure. Under the fire of 29 guns of Carter's battalion, which swept all the approaches to Ewell's line, the attacking force was driven back before it came well within reach of musketry, with a loss of over 2,000 killed and wounded. Grant gave up further effort; deeming it impracticable to break Lee's lines at Spottsylvania Court House, he issued orders on the 18th with a view to a movement to the North Anna to begin at 12 o'clock on the night of the 19th. In pursuance to this plan, on the 19th the Second and Ninth corps were moved to the left, the Ninth corps taking position on the left of the Sixth, with the Second in reserve. Late in the afternoon Ewell's corps attempted a flank march around Grant's left to ascertain the extent of his movement and get possession of the Fredericksburg road. He was met by Tyler's division of new troops, who, being reinforced by Crawford's division of the Fifth corps and Birney's of the Second, after a severe engagement lasting until dark, drove Ewell back. Some of Ewell's forces, pushing to the rear on the Fredericksburg road, met Ferrero's division of colored troops, by whom they were repulsed. Ewell's loss during the day was about 900. Grant reports his own loss as 196 killed, 1,090 wounded, and 249 missing. Ewell's attack delayed Grant's march for the North Anna 24 hours. On the night of the 20th the Second corps and a small force of cavalry under Gen. Torbert were pushed through Bowling Green to Milford, followed on the three succeeding days by the rest of the army. Lee followed, and the lines around Spottsylvania Court House were deserted. The entire losses of the Union army around Spottsylvania Court House from May 8 to 19 inclusive are estimated by Gen. Humphreys as 15,722 killed and wounded, and 2,001 missing, an aggregate of 17,723. The Confederate losses are not known, but were very severe. Consult: 'Official Records,' Vol. XXXVI.; Humphreys, 'The Virginia Campaign of 1864-5'; Walker, 'History of the Second Army Corps'; Powell, 'History of the Fifth Army Corps'; Pennypacker, 'Life of General Meade'; Grant, 'Personal Memoirs,' Vol. II.; Early, 'The Last Year of the War for Independence'; Fitzhugh Lee, 'Life of Gen. R. E. Lee'; Long, 'Life of Gen. Lee'; Gordon, 'Reminiscences of the Civil War'; The Century Company's 'Battles and Leaders of the Civil War,' Vol. IV.

E. A. Carman.

Spout-shell, a marine gasteropod (*Aporrhäis Pes-Pelecani*). This shell has its aperture produced into a spout-like process in front, and the general shape, produced by its elongated spines, together with its whitish color, have suggested the name "pelican's foot shell." The characters of the genus are found in the long spire of the shell, in the expanded outer lip, and in the finger-like projections of the shell.

Sprague, sprăg, **Austin Velorous Milton**, American inventor: b. Rochester, N. Y., 28 May 1840. He received special instruction in law, medicine, and engineering, and in 1865 went to the Pennsylvania oil-fields where he engaged in perfecting methods of improved oil production. The frequent explosion of boilers, caused by the use of the brackish water of the Allegheny river, suggested to him a plan for raising the water of the river to a reservoir whence it could be supplied to the boilers. He successfully executed his plan, overcoming the difficulty caused by an elevation of 740 feet in a distance of 2½ miles. He has invented various household articles, improvements in laundry machinery, disin-

Digitized by Google

fectors, thermaerotherapic apparatus, introduced steam for the sterilization of surgical instruments and dressings in 1890, began experiments in 1891 with hot dry air for therapeutical purposes, since generally adopted, and introduced the use of steam for the disinfection of textile fabrics in 1899.

Sprague, Frank Julian, American electrical engineer and inventor: b. Milford, Conn., 25 July 1857. While at high school in North Adams, Mass., he won competitive appointment to U. S. Naval Academy, from which he graduated with honors in 1878. He then became interested in electrical inventions and took a special course in physics under the late Admiral Sampson. Shortly after graduation he started on a tour of duty around the world, and was correspondent of the Boston Herald while General Grant was on the flagship of the Asiatic squadron. In 1882 he was appointed a member of the jury of awards at the Crystal Palace electrical exhibition, where he conducted all the tests on dynamo-electric machinery, electric lights, and gas engines, his report being published in full by the Navy Department. In 1883 he passed examination for promotion, then obtained a year's leave, resigned and became assistant to Thomas A. Edison; a year later parted company with Mr. Edison, and formed the Sprague Electric Railway and Motor Company, which, with his newly invented constant speed electric motor began active exploitation for industrial purposes. Began inventions in electric railways in the early 80's, and conducted extensive experiments on the New York Elevated Railway in 1886. Is generally recognized as the pioneer of the modern trolley road, the first important installation of which was made by him at Richmond, Va., in 1887–88. (See TRACTION, ELECTRIC.) In 1887 he invented the «multiple unit» system of electric train operation, by which several cars in a train are independently equipped, but all are under common control from several points. He was awarded a gold medal at the Paris Exhibition in 1889, the Elliot Cresson medal by the Franklin Institute in 1904, and the grand prize by the Louisiana Purchase Exposition for his inventions and developments in electric railways. He is a member of the Electrical Commission which has charge of the electrification of the N. Y. Cent. R. R. terminals. He has written many scientific papers on electric railways and kindred subjects.

Sprague, Homer Baxter, American educator: b. Sutton, Miss., 19 Oct. 1829. He was graduated from Yale in 1852, studied at the Yale Law School and in 1854 was admitted to the bar. He entered the Union army in 1861, was commissioned colonel in 1864 and in 1866 was mustered out of service. He was a member of the Connecticut legislature in 1868, professor at Cornell in 1868–70, and was founder and first president of Martha's Vineyard Summer Institute. He was president of Mill's College, California, in 1885–6, of the University of North Dakota in 1887–91, and has since been engaged as a lecturer at Drew Theological Seminary, Chautauqua assemblies, and elsewhere. He has written: ‹Fellowship of Slave-holders› (1857); ‹High School and Citizenship› (1883); ‹Voice and Gesture› (1874–1903); etc.

Sprague, William, American legislator: b. Cranston, R. I., 12 Sept. 1830. He entered the counting house of his father, senior partner of the A. and W. Sprague Manufacturing Company, when 16, and afterward with his brother succeeded to the ownership of the business. He was governor of Rhode Island in 1860–63 and was among the most active of the «war governors.» He went to the front, participated in the first battle of Bull Run and in the Peninsular campaign and in 1863 was elected to the United States senate, whereupon he resigned his governorship. He served in the senate until 1875 and then resumed his manufacturing business. He was married in 1863 to the celebrated Kate Chase, daughter of Salmon P. Chase, from whom he was afterward divorced.

Sprain, or **Strain,** the partial displacement or twisting of a joint with stretching, and more or less injury to the articulating apparatus; the ligaments, tendons, and their sheaths being all involved in the injury, while sometimes even small portions of the articulating processes of bones are separated. All joints are liable to this accident, but the wrist and ankle are most frequently the seat of this injury; their liability arising from their immobility, compared with such a joint as the shoulder, which is more liable to dislocation. A sprain is attended with violent pain, and the sufferer feels sick and faint. Swelling and discoloration rapidly take place from extravasation of blood into the sheaths of the tendons and the other surrounding tissues, through laceration of the smaller blood-vessels. Subsequently the swelling is kept up in consequence of the effusion of serum from the incited action which occurs. Thus the joint is much deformed, and great care is required in examining the parts to guard against mistakes and to gain an exact knowledge of the nature of the injury so as to ascertain decidedly and at once whether it be a simple sprain, or whether there be fracture or dislocation. If it is a simple sprain the part affected should be laid in an easy position on a pillow, and confined in that position by broad slips of bandage crossing the limb and pinned at each end of the sides of the pillow. The part should at first be fomented for an hour or two with cloths wrung out of warm water; afterward it is to be wrapped in cloths wetted with a warm lotion, say of sugar of lead, 1 dram; opium, 1 dram; and boiling water, 1 quart. These cloths, when applied, should be covered with oiled silk or cotton to prevent evaporation. Absolute rest is the principal point to be attended to. To secure this, when there is much restlessness, it sometimes becomes necessary to use splints. In case of inflammation, leeching may become necessary, also some purgative. After the pain abates and the swelling disappears, gentle rubbing with a soap and opium liniment is well, and a light flannel bandage should be applied. If the joint remains weak and stiff, stimulating frictions will be found useful, also the pouring of water on the part from a height, beginning with warm water, and after a time gradually reducing the temperature till the patient can bear it cold from the well. After each application the part must be well rubbed, as otherwise it may become rheumatic; rheumatism is a very common occurrence in parts injured by sprains and fractures. Too great caution cannot be applied in bringing a joint which has been sprained into use, as many diseases of joints are brought on by mismanagement.

Spreckels, sprĕk'ĕlz, **Claus,** American merchant: b. Lanstedt, Hanover, Germany, 1828; d. San Francisco, Cal., 26 Dec. 1908. He came to the United States in 1846

Digitized by Google

and settled in Charleston, S. C. In 1856 he went to San Francisco where he kept a store and later a brewery, and in 1863 established the Bay Sugar Refinery. He imported his raw materials from Hawaii where he acquired large properties, and owned in addition a beet sugar farm of 1,500 acres and a factory at Watsonville, Cal. He invented a new refining process and besides his sugar industry was a large owner in the Oceanic Steamship Co., operating between San Francisco and Honolulu.

Spree, sprā, a river of Germany which rises near New Salza in Saxony at a height of about 1,200 feet in the Riesengebirge, and follows a winding course, finally flowing into the Havel at Spandau. It is one of the principal tributaries of the latter river, and in its course traverses Berlin. Near Frankfurt it has connection with the Oder by the Friedrich Wilhelm canal. It is about 200 miles long.

Sprenger, sprĕng'ĕr, **Jacob**, German theologian of the 15th century, who with Heinrich Krämer, was the author of the 'Malleus Maleficarum' or 'Hexenhammer' (1489), which first formulated in detail the doctrine of witchcraft, and formed a text-book of procedure for witch trials. They were appointed inquisitors under the bull 'Summis desiderantes affectibus' of Innocent VIII. in 1484, and their work is arranged in three parts — 'Things that pertain to Witchcraft'; 'The Effects of Witchcraft'; and 'The Remedies for Witchcraft.' It discusses the question of the nature of demons; the causes why they seduce men, and particularly women; transformations into beasts, as wolves and cats; and the various charms and exorcisms to be employed against witches.

Sprigtail Duck, or **Pintail**, a very distinct species of fresh-water duck (*Dafila acuta*) the male of which is especially distinguished by the great prolongation and narrowness of the middle pair of tail-feathers. Both the females and the young of the latter have the tail-feathers very stiff and acute, but not otherwise peculiar. The sprigtail is a very handsome duck of more trim and slender appearance than most species and, including the tail, may reach 2½ feet in length. It inhabits the entire northern hemisphere and on the American side breeds in the northern United States and Canada and winters in the Southern States and the West Indies. It is, however, especially an inland duck, and, both when breeding and migrating, associates with teals and mallards in reedy sloughs and about lake margins. Its food being chiefly vegetable, and consisting largely of wild rice, it is one of the best of table ducks. A swift flyer and one of the most alert and wary of ducks, it affords fine sport to the skilful gunner. The nest is always on the ground near the water and hidden in rushes or grass, often at the base of a tree. As with most of the ducks, it is lined with down and the 6 to 12 elongated elliptical eggs are of a plain grayish olive color. See DUCK.

Spring, Gardiner, American Presbyterian clergyman, son of Samuel Spring (q.v.); b. Newburyport, Mass., 24 Feb. 1785; d. New York 18 Aug. 1873. He was graduated from Yale in 1805 and was admitted to the bar in 1808, but abandoned law for the ministry. He was ordained pastor of the Brick (Presbyterian) Church, New York, in 1810, and continued in that pastorate until his death. He declined the presidencies of Hamilton and Dartmouth Colleges. His publications include: 'Essays on the Distinguishing Traits of Christian Character' (1813); 'Obligations of the World to the Bible' (1844); 'The Glory of Christ' (1852); 'Brick Church Memorial' (1861); etc.

Spring, Leverett Wilson, American educator: b. Grafton, Vt., 5 Jan. 1840. He was graduated from Williams College in 1863, studied theology at Hartford and at Andover, and in 1868–81 was engaged in the Congregational ministry. He accepted the chair of English literature at the Kansas State University in 1881 and since 1886 has occupied a similar chair at Williams College. He edited the publications concerning the anniversary celebrations at Williams in 1893 and has published, 'Kansas' (1885); 'Mark Hopkins, Teacher' (1888); etc.

Spring, Samuel, American Congregational clergyman: b. Northbridge, Mass., 27 Feb. 1746; d. Newburyport, Mass., 4 March 1819. He was graduated from Princeton in 1771, was licensed to preach in 1774, became a chaplain in the Continental army in 1775, served under Arnold at Quebec, and in 1776 left the army. He was ordained in 1777 and from then until his death was pastor of the church at Newburyport. He was instrumental in uniting the two parties in the Congregational Church, was a founder of Andover Theological Seminary, and one of the organizers of the American board of commissioners for foreign missions.

Spring, the season of the year which follows winter and ushers in summer, and which in the United States includes the months of March, April and May. The first of these months, however, often presents, in the northern States, the harshest features of winter, although at other times genial and springlike. In the hot regions of Central and South America the seasons are divided into dry and wet, and the changes come suddenly, and without any transitional periods. The astronomical spring in the southern hemisphere begins 23 September and ends 21 December, corresponding in some degree to the northern autumn.

Spring, an outflow of water from the earth, or a stream of water at the place of its source. Springs have their origin in the water which falls upon the earth in the form of rain or snow, and sinks through porous soils till it arrives at a stratum impervious to water, where it forms subterranean reservoirs at various depths. When the pressure of the water which fills the channels through which it has descended is sufficient to overcome the resistance of the superincumbent mass of earth, the water breaks through the superficial strata and gushes forth in a spring; or it may find some natural channel or crevice by which to issue. In descending and rising through various mineral masses the water of springs often becomes impregnated with gaseous, saline, earthy, or metallic admixtures, as carbonic acid gas, sulphuretted hydrogen gas, nitrogen, carbonate of lime, silica, carbonate of iron, etc. When these substances are present in considerable quantity the springs become what are known as mineral springs. Warm and hot springs are common, especially in volcanic countries, where they are sometimes distinguished by violent ebullitions. Some springs run for a

Digitized by Google

time and then stop altogether, and after a time run again, and again stop; these are called intermittent springs. Others do not cease to flow, but only discharge a much smaller quantity of water for a certain time, and then give out a greater quantity; these are called variable springs. See MINERAL WATERS.

Spring, an elastic body, the elasticity of which is made practically available. Springs are made of various materials, as a strip or wire of steel coiled spirally, a steel rod or plate, strips of steel suitably joined together, a mass or strip of india-rubber, etc., which, when bent or forced from its natural state, has the power of recovering it again in virtue of its elasticity. Springs are used for various purposes — diminishing concussion, as in carriages; for motive power, acting through the tendency of a metallic coil to unwind itself, as in clocks and watches; or to communicate motion by sudden release from a state of tension, as the spring of a gun-lock, etc.; others are employed to measure weight and other force, as in the spring-balance, as regulators to control the movement of wheel-works, etc.

A spiral spring is one shaped like the main spring or hair spring of a watch. Such a spring lies wholly between two parallel planes whose distance apart is equal to the width of the wire or tape of which the spring is made. They possess the remarkable property of resisting distortion, when used, for example, to actuate a watch or chronometer balance, with a force which is very closely proportional to the amount of the distortion. It is this property which insures the isochronism of the motion of a watch or chronometer balance. Helical springs, also commonly called spiral springs, are formed by winding wire into a helix about a right circular cylinder. They also possess the remarkable property of resisting elongation with a force which is nearly proportional to the amount of the elongation. This property is utilized in the spring balance, much used in trade to measure weights. To the next higher order of approximation the force required to elongate a helical spring is proportional to the product of the elongation and the square of the secant of the slope, or pitch, of the spring. Consult: Routh, 'Rigid Dynamics'; Thomson and Tait, 'Natural Philosophy.'

Spring, a term used in navigation, and meaning a crack running transversely or obliquely through any part of a mast or yard, so as to render it unsafe to carry the usual quantity of sail thereon. It also means a rope passed out of a ship's stern, and attached to a cable proceeding from her bow, when she lies at anchor; also a rope extending diagonally from the stern of one ship to the head of another which lies abreast of her at a short distance, and used to make one of the ships sheer off to a greater distance from the other.

Spring or **Green Frog.** See FROG.

Spring Beauty. See CLAYTONIA.

Spring-beetles, or Click-beetles. See ELATER.

Spring-halt, or **String-halt**, a sudden involuntary twitching or convulsive movement of the muscles of either hind leg in the horse, the leg being raised unnaturally high and lowered with excessive force. Although it may not impair the usefulness of the animal, the defect lessens its value by injuring its gait and, to some extent, its appearance.

Spring Hill College, a Roman Catholic institution located at Mobile, Ala. It was founded in 1830 by the Jesuits and remains under their control. It offers, in addition to the collegiate courses, a preparatory course, and a commercial course. The degrees of A.B. and B.S. are conferred. There is no endowment; the grounds and buildings in 1910 were valued at over $1,000,000; the library contained 40,000 volumes; the students in 1910 numbered 184, and the faculty 24.

Spring Hill, Engagement at. After Gen. Sherman had started from Atlanta, on his march to the sea (q.v.), Gen. Hood, commanding the Confederate Army of Tennessee, marched northward from Florence, Ala., 19 Nov. 1864, to drive Gen. Thomas from Nashville and back to the Ohio River. Thomas, who proposed to concentrate his own army on the line of Duck River and the Nashville and Chattanooga Railroad, and to await expected reinforcements, withdrew his advance posts from Pulaski and other points to Columbia, on Duck River, where works were thrown up, covering the approaches from the south. He had there on the 26th about 23,000 infantry and 5,000 cavalry, only 3,500 of the cavalry being mounted. Gen. Schofield was in command. His infantry consisted of two divisions of the Twenty-third corps and the three divisions of Stanley's Fourth corps. Gen. J. H. Wilson commanded the cavalry. Gen. Hood, preceded by Gen. Forrest with 6,000 cavalry, appeared before Columbia on the 26th and with the three corps of Gens. S. D. Lee, A. P. Stewart, and B. F. Cheatham, about 40,000 men, and threatened a crossing of the river above and below. During the night of the 27th Schofield withdrew to the north bank of the river, where he remained on the 28th. The two divisions of the Twenty-third corps were placed in position in front of Columbia, holding all the crossings of the river in the vicinity, with Stanley's Fourth corps in reserve on the Franklin pike, ready to move whenever Hood should attempt a crossing above or below the town. Wilson's cavalry held the crossings above those guarded by the infantry. Forrest succeeded in crossing one of his divisions, above Columbia, before noon of the 28th, pushing Wilson's cavalry back on roads leading toward Spring Hill and Franklin, and Hood began crossing his infantry at daylight of the 29th at Huey's Mills, five miles above Columbia, from which a good road leads into the Columbia and Franklin pike, at Spring Hill, 15 miles north of Columbia, a road by which he could intercept Schofield's march to Franklin and strike him in flank. Wilson had despatched Schofield, at 1 A.M. of the 29th, that Hood would undoubtedly cross the river at daylight, and suggested an immediate withdrawal to Franklin. At daybreak Schofield sent Col. Post's brigade up the river to ascertain if Hood had really crossed, and ordered Gen. Stanley, with the two divisions of Wagner and Kimball, the trains, and the reserve artillery, to Spring Hill, to cover that point and hold the road open for the passage of the entire army. At 8 A.M. Stanley was on the march. On reaching Rutherford's Creek,

Digitized by Google

four miles from Columbia, Kimball's division was halted and faced east to cover the crossing against a possible attack, and remained in this position during the entire day. Stanley, with Wagner's division, pushed on, and it was nearing noon, when his head of column had approached to within two miles of Spring Hill, that he was informed that Buford's division of Forrest's cavalry was approaching from the east. The troops were quickly thrown forward, and Bradley's brigade, deploying as it advanced, drove off Buford's men, just as they had driven back a small force of cavalry and infantry and were about to occupy the village. As the other two brigades came up, they also were deployed from the railroad on the north to the pike on the south, covering the village in a semicircle, in which was placed the train. Bradley's brigade was sent half a mile to the front and right to occupy a knoll commanding all the approaches from the east. The greater part of the artillery was posted on a rise of ground south of the town. Scarcely had these dispositions been completed when Hood attacked. It was before sunrise when Cheatham's corps began crossing the river, Cleburne's division in advance. Hood accompanied Cleburne on the direct road to Spring Hill. Stewart's corps and Johnson's division of Lee's followed Cheatham, leaving Lee, with the remainder of his corps, in front of Columbia. Cleburne approached Spring Hill about 3 P.M., just as Bradley's brigade was taking position and immediately attacked it, and at the same time an attack was made by Forrest's cavalry at Thompson's Station, three miles north, on a small wagon-train pushing for Franklin, and a cavalry dash on the Spring Hill station northwest of the town. Cleburne's assault on Bradley was twice repulsed, but in a third front and flank attack Bradley was severely wounded, and his brigade driven back to the edge of the village, where it was rallied and put in position to cover the wagon-train, part of which had reached Spring Hill. Cleburne endeavored to follow up his advantage, but was repulsed by the fire of eight pieces of artillery. Bradley's loss was about 150 killed and wounded; that of the Confederates was somewhat more. It was now sunset and the engagement ended. The result of it was that the Confederate infantry was checked when within 800 yards of the road, but their cavalry had gained the road both north and south of the town. Stanley, with his one division of not more than 4,000 men, was in a critical position; his nearest support was Kimball, who was more than eight miles in his rear; the other divisions of the army were still at Duck River. But fortunately for Stanley and the whole of Schofield's army, Hood's efforts to press the attack and gain the road miscarried, and Cheatham's corps bivouacked not more than half a mile from the road over which Schofield's army was obliged to pass from Columbia to Franklin. Stewart arrived after dark and formed on Cheatham's right, and by 8 P.M. two corps of Hood's army were in position facing the road and not over half a mile from it. There has been much Confederate contention as to who was responsible for the failure to seize the road and prevent Schofield's escape. Hood says: «Nothing was done. The Federals, with immense wagon-trains, were permitted to march by us the remainder of the night, within gunshot of our lines. I could not succeed in arousing the troops to action, when one good division would have sufficed to do the work.»

Gen. Schofield, who had remained during the day at Columbia, started late in the afternoon, with Ruger's division and Whittaker's brigade, for Spring Hill, and when about three miles from the town, came upon the Confederate cavalry holding the road, which was driven off, after quite a skirmish. Leaving Whittaker to cover a cross-road a mile or two below the town, and to observe the Confederates, who could be seen standing around their camp fires, Schofield continued his march with Ruger to Spring Hill, which he reached about 7 P.M., and two hours later moved on to force a passage at Thompson's Station. The Confederates withdrew on his approach, the road to Franklin was clear, and Ruger took possession of the cross-roads. Schofield returned to Spring Hill, where, meanwhile, Gen. Cox had arrived with his division of the Twenty-third corps. Just before midnight Cox was ordered to start for Franklin, with instructions to take Ruger with him. He was fairly on the road by 1 A.M. of the 30th, at which hour the train of 800 wagons was started to follow Cox. At the very start the train was obliged to cross a bridge in single file, which made the movement so difficult and caused so much delay that Stanley was advised to abandon part of the train, to which he would not consent, and it was almost 5 A.M. before the rear of the train was fairly under way. As the head of the train passed Spring Hill it was attacked by cavalry and some wagons destroyed, but Wood's division, which had followed Cox from Duck River, was thrown on the flank of the train and the enemy driven off. It was near daybreak when the last wagon left Spring Hill. Kimball's division followed Wood's and at 4 A.M. Wagner followed Kimball, his skirmishers remaining until nearly daylight. Opdycke's brigade was rear-guard, and although hard pressed by Confederate cavalry, not a man nor a wagon was left behind. When the rear of the column was leaving Spring Hill, the head of it was at Franklin. Seldom has an army made such a narrow escape from destruction or capture. Consult: 'Official Records,' Vol. XLV.; the Century Company's 'Battles and Leaders of the Civil War,' Vol. IV.; Van Horne, 'History of the Army of the Cumberland,' Vol. II.

E. A. CARMAN.

Spring Tide, the tide which happens at the full moon, which rises higher than common tides. At these times the sun and moon are in a straight line with the earth, and their combined influence in raising the waters of the ocean is the greatest, consequently the tides thus produced are the highest. See TIDE.

Spring Valley, Ill., city, Bureau County; on the Illinois River, and on the Chicago, B. & Q., the Chicago & N. W., and the Chicago, R. I. & P. R.R.'s; 100 miles southwest of Chicago. It is the centre of a coal mining region, and mining is the chief industry; it has also important manufacturing interests, the census of 1900 reporting 32 manufacturing establishments in the city with a capital of $42,741. These include pump factories, foundries, machine shops, etc. There is a national bank with a capital of $50,000.

Digitized by Google

It has a public high school. Pop. (1890) 3,837; (1900) 6,214; (1910) 7,467.

Spring'al, an ancient warlike engine, used for shooting large arrows, pieces of iron, etc. It is supposed to have resembled the cross-bow in its construction.

Spring'bok, a small South African antelope or gazelle (*Gazella euchore*), about 30 inches in height, and rich cinnamon-yellow on the upper parts, white on the belly, buttocks and face, and with stout, ringed, lyrate horns. It formerly gathered and migrated in enormous herds, but has now become uncommon in the more settled districts. It was remarkable among gazelles for its extreme agility and powers of jumping, and for a stripe of long white erectile hairs along the spine. Consult: Sclater and Thomas, 'The Book of Antelopes' (London 1896), and the writings of South African travelers.

Spring'er, Reuben Runyan, American philanthropist: b. Frankfort, Ky., 16 Nov. 1800; d. Cincinnati 10 Dec. 1884. At the age of 21 he became clerk on an Ohio River steamboat and in 1830 became partner in the grocery firm of Kilgour, Taylor & Company, Cincinnati. In this business and in various investments he accumulated a large fortune which he used for a variety of benevolent enterprises. He contributed over $200,000 to the building of the Cincinnati Music Hall, and gave other large amounts to the Art Museum, the College of Music and the Exposition Building.

Springer, William McKendree, American jurist: b. New Lebanon, Ind., 30 May 1836; d. Washington, D. C., 4 Dec. 1903. He was graduated from the Indiana State University in 1858, and was admitted to the bar in 1861, beginning the practice of law at Springfield, Ill. In 1871 he entered the Illinois legislature and two years later was sent to Congress on the Democratic ticket. During his ten successive terms he was prominent as temporary speaker, as chairman of the Ways and Means Committee and as a participant in tariff and currency debates. He was the author of the resolution passed by the 44th Congress against the election of any person for a third term in the presidency, and served on the Potter committee which investigated the election of 1876, and also on the joint committee which reported the Electoral Commission bill. As chairman of the Committee on Territories he was the author of the bill organizing Oklahoma Territory, and of the bill admitting Washington, Montana, North Dakota and South Dakota as States. In 1895 he was appointed judge of the United States Supreme Court for the Northern District of Indian Territory and chief justice of the court of appeals of the territory. In 1899 he removed to Washington and resumed the practice of law.

Spring'field, Ill., city, county-seat of Sangamon County and capital of the State, is in the centre of the great corn-belt; on the Illinois Central, the Chicago & A., the Chicago, P. & St. L., the Wabash, the Cincinnati, H. & D., and the Baltimore & O. R.R.'s; 190 miles south of Chicago; 90 miles north of Saint Louis and near the Sangamon River. It is built on an undulating and well-wooded prairie and is beautifully laid out. The city is compactly built and has well paved and beautifully shaded streets. Springfield is the centre of the great coal mining industry of Sangamon County, whose product of coal in the year 1902 was 3,672,989 tons and the largest of any county in the State. This industry in the same year employed 4,287 men and represents a population of fully 20,000. The Illinois State Fair is permanently located here. Large and expensive buildings have been erected at a cost of $500,000. The grounds are extensive and highly improved. The annual fairs have come to be little less than a liberal exposition.

The Capitol Building.— The most conspicuous public building is the State Capitol, which was completed in 1887. It stands in a park of eight acres, and cost over $4,000,000. The ground plan is in the form of a huge cross and the superstructure is of the modern classic style. The extreme length is 379 feet and the extreme width 286 feet. The exterior walls are of dressed Joliet limestone, the lofty porticoes of sandstone, supported by columns of polished gray granite. The edifice is three stories high with a mansard roof and two turrets, and the massive symmetrical dome, the highest in the United States, is an object of great admiration.

The Lincoln Monument.— Among the many historical attractions of Springfield are the Lincoln National Monument and the Lincoln residence. Both are owned by the State and are in charge of custodians. They are open daily to the public. The Lincoln National Monument stands in Oak Ridge Cemetery, something over a mile north from the State House. The mausoleum contains the remains of President Lincoln, his wife, two children, and one grandchild. The monument and the four heroic bronze groups, three representing the infantry, artillery, and cavalry branch of the army, and the fourth, the navy, were designed by the sculptor Larkin G. Meade. It was dedicated 15 Oct. 1874 and cost about $350,000.

Public Buildings.— Among the prominent structures in Springfield are the United States Court House and Post-office, the County Court House, the Governor's Mansion, the State Arsenal and Armory, City Hall, Public Library, Bettie Stuart Institute, Odd Fellows Building, Springfield and Saint John's Hospitals, and David Prince Sanitarium.

Libraries.— In proportion to the size of the city the Springfield Public Library at one time claimed to be the largest in the United States. It then contained over 58,000 volumes. Here also is the State Library of 55,000 volumes; the State Historical Library of 3,500 volumes, and many rare historical pamphlets, maps, etc., and the Supreme Court Law Library of 18,000 volumes.

Industries.— Springfield is the centre of an extensive coal mining, farming, horse and cattle breeding section, and has large manufacturing interests. In the year 1909 the invested capital in manufactures amounted to upward of $7,174,000 with an annual output of products valued at $8,497,000. The Illinois Watch Company has an immense establishment here, employing about 2,000 operatives. There are several large printing and publishing houses, textile works, planing and wood working mills, machine shops, woolen mills, breweries, engine, boiler and car works, and manufactories of flour,

Digitized by Google

clothing, boots and shoes, saddlery, soap, etc. The assessed property valuation exceeds $15,-695,000.

Banking and Finance.—On 1 March 1910, Springfield had a net public debt of $825,800 and the municipal receipts for a single year amount approximately to $500,000. This item of receipts does not include any school tax. In the same year there were five national banks with an aggregate capital of $1,450,000. One state bank, $300,000, and one trust company, $100,000. The average deposits in all these institutions was $10,500,000. There are nine building and loan associations with 3,672 shareholders.

Government.—The city is governed on the commission plan, under revised charter regulations. The municipal expenses for a single fiscal year are approximately $450,000,000, exclusive of school expenses, and the municipal receipts for the same period, also exclusive of school tax, amounted to $500,000. The water-works are owned by the city and have a daily capacity of 12,000,000 gallons. This capacity may be increased almost indefinitely without great cost. There is a complete sewage system, electric light plant, 25 miles of electric street railway, 366 acres of improved park land, and 30 miles of paved streets.

Education.—The expense of the public schools does not appear in the municipal financial statement, but there is raised annually by taxation a sum sufficient to maintain public schools and to erect new buildings as required. The cost of maintaining the public schools for the school year of 1909-1910 was $269,314; this includes the sum of $57,184 for improvements. There were enrolled in the same period 6,951 pupils, and the cost of tuition per pupil enrolled was $18.13 per annum. The total estimated actual value of property subject to taxation for school purposes is $35,000,000. There are employed in the public schools 173 teachers, 22 of whom are men and 151 women. There are 17 school buildings, 16 of which are graded schools and one high school. The high school building, recently erected at a cost of $100,000, is a model in its way and has capacity sufficient to accommodate 900 pupils. There are located here the Ursuline Convent, the Convent of Our Lady of the Sacred Heart, Saint Peter's Convent, Saint Paul's Convent, and seven parochial schools, the Concordia Lutheran College, Springfield Business College, and the Saint Agatha School.

Religion.—Springfield has a total of 48 churches of all denominations, the Methodist leading with 8, the Baptist next with 7, Roman Catholic 6, Presbyterian 6, Episcopalian 4, etc. There are two Hebrew synagogues and one Christian Science Congregation. Among the charitable institutions are the Home for the Friendless, the Home for Aged Women, the Home for Aged People under the control of the Roman Catholic Church, the Orphanage of the Holy Child, and the Colored Old Folks' Home.

History.—Springfield was first settled in 1819 and was laid out in 1823 at which time it became the county-seat. It was first incorporated as a town in 1832 and was chartered as a city in 1840. It was selected as the State capital in 1837 and the State legislature assembled here for the first time in 1839.

Population.—(1890) 24,963; (1900) 34,159; (1910) 51,678.

SAMUEL P. WHEELER,
Attorney at Law, Springfield, Ill.

Springfield, Mass., city, port of delivery, and county-seat, of Hampden County; on the east bank of the Connecticut River, and on the Boston & Albany division of the New York Central, the Connecticut & Passumpsic division of the Boston & Maine, and the Hartford, Highland and Central New England divisions of the New York, New Haven & Hartford Railroads; 99 miles west of Boston, and 136 miles northeast of New York. The place is noted for its beauty, being laid out with wide and well-shaded streets and being especially attractive as a residential city. Four bridges span the Connecticut River here. The railroads entering the city built a union depot in 1889 at a cost of $500,000. The elevated sections of the city command delightful views of the Connecticut Valley.

Parks and Monuments.—There is an extensive public park system comprising 500 acres. Forest Park contains 464 acres, and contains a collection of birds and animals. There are many small parks and squares throughout the city. In Merrick Terrace stands a statue, «The Puritan,» by Saint Gaudens, and on Court Square is a soldiers' and sailors' monument and statues of Miles Morgan by Jonathan Scott Hartley, and President William McKinley by Philip Martiny. Hampden Park, containing 54½ acres, has been famous for its horse races and cycling tournaments.

The Arsenal.—The United States armory and arsenal are located here, and about 1,250 men are employed making arms for the government. The output of rifles will average 1,350 weekly. The arsenal building is 200 by 70 feet, and accommodates 300,000 stands of arms. The government building erected here in 1891 at a cost of $175,000 contains the custom office and the post-office.

Public Buildings.—Among the leading buildings in the city are the County Court House, the Church of the Unity, the railway station, the Science Museum, the Art Museum, and the high school building.

Manufactures.—In 1909 the industries of Springfield represented a capital of $28,658,000, with an annual output valued at $31,773,000. The leading manufactures include fire-arms, railroad cars and supplies, envelopes, papeteries, dictionaries, cotton goods, skates, valves, buttons, needles, toys, printed books, art goods, confectionery, tobacco products, forgings, machinery, bicycles, automobiles, and electrical supplies.

Commerce.—The imports at Springfield for a single year amount to over $100,000, and the duty collected amounts to about $50,000.

Banks and Banking.—In 1910 there were four national banks with a combined capital of $1,900,000; three savings banks with a total of $30,000,000 in deposits; one safe deposit company with $500,000 capital, the Massachusetts Mutual Life Insurance Company, the Springfield Fire and Marine Insurance Company, and a bank clearing house, which cleared $114,695,800

Digitized by Google

in 1910. The city has a Board of Trade and various commerical and social organizations.

Government.— The city is governed by a mayor, elected annually, and a bicameral council. The municipal expenses aggregate about $1,500,000 annually, including $375,000 for schools; $195,000 for streets; $115,000 for fire department; $86,000 for police; $74,000 for lighting, and $54,000 for the poor. The waterworks are owned and operated by the city. The system cost over $2,000,000. In 1910 the city had a net funded debt of $4,240,161. The assessed valuation of real and personal property in the same year was $119,081,778.

Education.— The public school system embraces high, grammar, primary, manual training, trade, and kindergarten schools, occupying 34 buildings. The evening trade school is said to be the first of its kind in the United States. There are 374 teachers and 11,000 pupils. The parochial schools have 1,500 pupils. Springfield is the seat of the French-American College, opened in 1885, and the International Y. M. C. A. Training School. There is a public library here containing 130,000 volumes, and the Hampden County Law Library dating from 1813. The facilities and collections of the art and science museums,— departments of the City Library,— are perhaps unrivaled in any city of similar size in the country; the library itself is of unusual efficiency. The system of public education is considered one of the most advanced in the United States. The city is the home of two famous publishing enterprises — 'Webster's Dictionary' and the Springfield *Republican.*

Religion.— There are upward of 50 churches in Springfield, of which 12 are Congregational, 7 Methodist, 7 Baptist, 6 Roman Catholic, 3 Universalist, 2 Episcopalian, 2 Lutheran, and also Unitarian, Hebrew, and other denominations. The charitable institutions include the City Almshouse, Springfield Hospital, Mercy Hospital, and the Hampden Homœopathic Hospital.

History.— Springfield was first settled in 1636 by a party of emigrants from Roxbury under the leadership of William Pynchon. Until 1640, when it received the name of Springfield (from Springfield, England, the home of Pynchon), the town was known as Agawam. West Springfield, Chicopee, and several of the neighboring towns were then included in its boundaries. On 5 Oct. 1675, during King Philip's War, the town was attacked by Indians and burned. In September 1786, during Shays' Rebellion (q.v.) it was the scene of a riot headed by Daniel Shays. In January 1787 occurred a skirmish between the State militia and 1,000 insurgents led by Shays, in which the latter were defeated. The city was incorporated in 1852.

Population.— Springfield had a population of 2,312 in 1800; (1850) 11,766; (1880) 33,340; (1890) 44,179; (1900) 62,059; (1910) 88,926.

References.— Burt, 'The First Century of the History of Springfield' (1888); Green, 'Springfield, 1686–1886' (1888).

Springfield, Mo., city, county-seat of Green County; on the Saint Louis & S. F., and the Kansas City, F. S. & M. R.R.'s; about 130 miles south of Jefferson City, the capital of the State. In the early part of the Civil War, there occurred in the city and vicinity several battles. One, which is known as the battle of Wilson's Creek, took place 10 Aug. 1861; the Union forces were defeated and the Union general, Nathaniel Lyon, was killed. The city is on the ridge of the Ozark Mountains in a region known for its valuable deposits of zinc and lead. The climate is healthful and warm temperate about all the year. Its industries are chiefly connected with the mining and marketing of lead and zinc. The chief industrial establishments are two large railroad-shops, iron works, machine shops, wagon and carriage factories, furniture factories, flour mills, and novelty works. The government census of 1900 gives as the total number of manufacturing establishments 245; the amount of capital invested $2,111,048; number of wage-earners, 2,127; average annual wages, $1,017,345; cost of material used, $2,274,705; value of products, $4,126,871. It has an extensive trade in manufactures, lead and zinc and as a jobbing centre for a large part of the southern counties. The principal public buildings are the government buildings, county court-house, municipal buildings, Saint John's Hospital, Springfield Frisco Hospital, the bank buildings, and several fine building blocks. The educational institutions are a State Normal School, Loretto Academy (R.C.), Drury College (Cong.), public and parish elementary schools, and a public library. There are the National and Confederate cemeteries, parks, and in the vicinity many places where the scenery is most beautiful. Pop. (1890) 21,850; (1900) 23,267; (1910) 35,201.

Springfield (Mo.), Military Operations at. As the central point of southwestern Missouri, Springfield was an important place in military operations during the Civil War. After the engagement at Carthage (q.v.), 5 July 1861, Col. Sigel retreated to Springfield, where he was joined by Gen. Nathaniel Lyon (q.v.) on the 13th, Lyon assuming command of all the Union forces, and calling for more to make head against the combined forces of Gens. Sterling Price and Ben. McCulloch, a call that brought no response. On 1 August, hearing of the Confederate advance, Lyon marched from Springfield with 6,000 men and 18 guns against it, and next day at Dug Springs, 19 miles from the city, his advance encountered and drove back the Confederates under Gen. Rains, with slight loss, and returned to Springfield on the 5th, which he thought he should be compelled to abandon, falling back either to Saint Louis or Kansas, as he was largely outnumbered. He reported the condition of affairs to Gen. Frémont (q.v.) in command at Saint Louis, held his position, and advancing on 10 August, fought the battle of Wilson's Creek (q.v.), nine miles southwest of Springfield, and was killed. His army, under Col. Sigel, retreated through Springfield to Rolla, the Confederates following only to Springfield, which they held until the 25th, when they moved against Lexington. On 13 August Frémont, hearing of the Wilson's Creek disaster, Lyon's death, and the unobstructed retreat of Sigel on Rolla, sent reinforcements to Rolla, and at the end of September he left Saint Louis with an army of 38,000 men and 86 guns to take the field in southwestern Missouri, against Sterling Price (q.v.). His five columns

Digitized by Google

were directed on Springfield. On 23 October, when about 50 miles from Springfield, Frémont sent Maj. Zagonyi, with about 250 men of his bodyguard and of the "Irish Brigade" (37th Illinois) to advance on the place. Zagonyi reached Springfield on the 25th. It was then held by about 1,000 recruits, some mounted, and some on foot, and after several charges Zagonyi routed them, his loss being 15 killed, 27 wounded, and 10 missing. Frémont occupied the place on the 27th with 21,000 effective men, and was about to advance and give battle to the Confederates, when (2 November) he was relieved in command by Gen. Hunter, who withdrew the army to Rolla. Price reoccupied Springfield and began to recruit an army to recover Saint Louis, and had gathered some 8,000 men by 12 Feb. 1862, when he was driven from the place by Gen. Curtis, Price retreating into Arkansas. Springfield now became a depot of supplies, and was well fortified. Early in January 1863, Gen. Marmaduke (q.v.) with 4,000 mounted men and 3 guns, started from northern Arkansas on a raid into Missouri, and with a part of his command appeared before Springfield on the morning of the 8th. Gen. E. B. Brown, in command of the place, had but short notice of his approach, but gathered some militia from the adjoining country, which, with his regular command, convalescents from the hospitals, and some citizens, gave him about 2,100 men. The fight began about 10 A.M. of the 8th and continued until dark. Marmaduke's men drove in parts of the line, captured one gun, carried some of the works, and seized part of the town, but Brown held the strongest fort against all efforts to take it. On the morning of the 9th Marmaduke withdrew in the direction of Rolla, after a loss of 20 killed, 105 wounded, and 26 missing. The Union loss was 14 killed, 146 wounded, and 5 missing. E. A. CARMAN.

Springfield, N. J., township in Union County; on the Rahway River, and on the Delaware & Lackawanna Railroad; eight miles southwest of Newark. The chief manufactories are boot and shoe factories, paper mills, and hat factory. Springfield is celebrated as the scene of a battle between the American and British forces, 23 June 1780. The British, under General Knyphausen, advanced from Elizabethtown about 5 o'clock in the morning. They were opposed by General Greene, but owing to the superior number of the enemy he was compelled to evacuate Springfield, which was then burned by the British. During the action the Rev. James Caldwell, chaplain in the New Jersey brigade, is said to have distributed the hymn books from the neighboring Presbyterian church among the soldiers for wadding, saying at the same time, "Now put Watts into them, boys." This battle prevented further advance on the part of the British. The American loss was about 72 and that of the British about 150. Pop. (1910) 1,246.

Springfield, Ohio, city, county-seat of Clark County, on the Lagonda Creek and the Mad River, and on the Pittsburg, Cincinnati, Chicago & Saint Louis, the Cleveland, Cincinnati, Chicago & Saint Louis, the Erie, and the Detroit Southern R.R.'s; about 45 miles west of Columbus. Five lines of electric railways provide direct connections with the cities of Columbus, Dayton, Xenia, Urbana, Bellefontaine, Troy, and Piqua.

Manufacturing.— The surroundings of the city were naturally rich in the possibilities of agriculture. An abundance of water power, utilized in woolen, cotton, flour and powder mills, enabled the early settlers to supply many of the needs of a pioneer community. In later years native genius turned the drift of the city's principal energies into the line of manufactures with the result that the fame of Springfield, as a manufacturing centre, is literally world-wide, and, especially, in respect to the fabrication of implements designed for the planting, cultivation and harvesting of the great staple crops. The developments of more recent years have given these manufactures a varied character embracing gas and steam engines, piano plates, machinery in vast variety, tools, mechanical appliances and factory supplies, in iron, steel and brass. Periodical publications of high class and national renown, and floral industries exceeded in aggregate extent by those of few cities in the Union, contribute to Springfield's commercial prestige and distinction. Flour, medicine, food, wearing apparel, chemical, coffin, rubber and paper manufactures add variety to the list of Springfield's notable products. The government census of 1900 gives the total number of manufacturing establishments as 305; the amount of capital invested, $14,091,175, the number of employees, 6,638; the average annual wages, $3,160,119; and the average value of the annual products $12,777,173. There were seven large manufactories of agricultural implements, with an invested capital of $8,194,543. The 30 foundry and machine-shops had a combined capital of $2,772,036. They had 2,197 employees, to whom was paid annually, on an average, wages amounting to $1,084,681. The value of the annual products was $3,097,910. Since 1900 there has been a notable increase in the amount of manufacturing. In 1910 there were estimated 10,000 employees in the various industries and the value of the annual output is about $18,000,000.

Transportation and Commerce.— Ample shipping facilities afforded by the steam lines mentioned, ready access to the coal fields of various States and an excellent supply of natural gas fuel are prominent factors in the city's advancement. At an early stage of the development of electric traction lines Springfield took rank as one of the chief centres of Ohio.

Local mercantile interests in lines both of wholesale and retail trade reflect the conditions of a thrifty, growing community.

The Commercial Club, embracing a membership of 300 representative citizens, is the agency for organized effort in the promotion of the growth of the city, and the conservation of all its material interests. Four live and progressive daily newspapers give voice and direction to public-spirited sentiment and action.

Buildings and Municipal Improvements.— The United States post-office building was erected and equipped in 1890, at a cost of $150,000. The 11 rural free delivery routes add over 6,000 the number served by the Springfield office. The Clark County court-house, a handsome structure is supplemented by a County office building, or striking architectural design and modern construction, the two buildings representing an ex-

Digitized by Google

penditure of more than $200,000. The City Building cost $250,000, and is one of the finest edifices of its kind in the State, providing a city market 300 feet in length, and a spacious auditorium in addition to quarters for municipal officers. Fronting the City Building are the handsome and graceful Kelly fountain and esplanade which cost $8,000, and were presented to the city by Oliver S. Kelly. The city hospital, founded by the liberal donations of Ross Mitchell and J. H. Thomas and endowed in the sum of $100,000 in government bonds by John Snyder, was erected and furnished at a cost to the city of $100,000 It is equipped with every appliance and convenience essential to its use. The city prison and patrol station, the cost of which was $20,000, is of modern design and construction. Three State fraternal homes have been erected on the hills which border the city. These homes are maintained by the brotherhood of the Masonic craft, the Independent Order of Odd Fellows, and the Knights of Pythias. The city donated the sites on which the institutions are located, the funds being provided by voluntary contributions amounting to $100,000. Asa Smith Bushnell gave to the Masonic Home the sum of $10,000. Thousands of representatives of the fraternal orders annually visit these homes. The Lagonda Club has a handsome building which cost $25,000. The Young Men's Christian Association building, erected by the gifts of the people of Springfield, cost $90,000. Asa Smith Bushnell and Edwin S. Kelly each contributed $5,000.

Snyder Park, a tract of 217 acres, was the gift of John and David L. Snyder. Other donations by the same public benefactors were those of $25,000 for a memorial bridge, and $200,000 in government bonds in endowment of the park. A memorial arch, erected to the memory of the Messrs. Snyder, by the people of Springfield, at a cost of $6,000, is to span the entrance to Snyder Park, and was dedicated 4 July 1904. Ferncliff, Springfield's principal burial ground, occupies a site of surpassing beauty. Springfield has an abundant supply of pure water. The waterworks system cost $800,000. Ample fire pressure is maintained, but the city fire department equipment includes three steam engines of large power.

Churches, Schools, Libraries.— The city has 50 churches, a large number of which are of modern construction and striking artistic beauty. There are 19 public school buildings, four Roman Catholic parish schools, two private business colleges and several private schools. The Springfield Seminary is one of the large city schools. The Wittenberg College, founded in 1845, by the Lutheran Church, has in attendance about 400 students. The Warder public library, which cost $100,000, is a gift from Benjamin H. Warder. It contains 20,000 volumes and is maintained by an annual appropriation. More than a score of literary clubs contribute to the culture and refinement which are marked characteristics of the people of the city.

Banks and Finances.— There are six banks, five national and one savings bank. The national banks have a combined capital of $1,000,000; the six banks have deposits amounting to $5,214,520. There are four building and loan associations with assets in excess of $1,500,000. The bank clearings increased from $14,362,664 in 1899, to $27,197,800 in 1910. The gross receipts of the post-office were, in 1899, $117,695 and in 1903, $163,041. The aggregate financial transactions of the post-office, in 1910, were $1,000,000. The aggregate value of the real and personal property, as assessed for taxation, for the year 1910, was $22,581,030.

History.— The plat of the town was made in 1801 by James Demint. The city was chartered in 1850. The life of the city is told by the growth of its industries, charitable institutions, churches, and schools. It has been the home of many noted men, among whom may be mentioned Joseph Warren Keifer (q.v.) and Asa Smith Bushnell (q.v.). Pop. (1900) 38,253; (1910) 46,921.

JAMES H. RABBITTS.

Springfield Rifle. See ORDNANCE; SMALL ARMS.

Spring'tails, a family of wingless insects of the order *Collembola* (q.v.), distinguished by the possession of an elastic forked caudal appendage, folded under the body when at rest, by the sudden extension of which these insects are enabled to make considerable leaps. Their scales are favorite test-objects for microscopes. Compare BRISTLETAILS.

Sprit, a small boom or pole which crosses the sail of a boat diagonally from the mast to the upper aftmost corner, which it is used to extend and elevate. These sails are accordingly called sprit-sails. A sail attached to a yard hanging under the bow-sprit was also formerly so called.

Spruce, or **Spruce-fir,** a coniferous tree of the subfamily *Abietinæ* and especially of the genus *Abies*. One of the best known and typical is the Norway spruce (*A. excelsa*), which is indigenous in the north of Europe where it is the loftiest (often 125 feet) of forest trees, but has been transplanted as an ornament to all cool climates. The American spruces are described under FIR.

Spruce-Beer. Essence of spruce is simply a decoction of the young green tops of the Black Spruce, boiled and evaporated to the consistence of a thick syrup. Spruce beer of good quality may be prepared as follows:— Essence of spruce one half pint; pimento and ginger (bruised) of each five ounces; hops, one half pound; water, three gallons; boil the whole for ten minutes, then add of moist sugar 12 pounds (or good treacle 14 pounds); warm water, 11 gallons; mix well, and when lukewarm add a pint of yeast; after the liquid has fermented for about 24 hours it is ready for bottling. This beer is regarded as a diuretic and antiscorbutic, and is relished by many as an agreeable summer beverage.

Spruce Partridge. See GROUSE.

Spur, a metal instrument composed of a shank, neck, and prick or rowel, fastened to the heel of a horseman to goad his horse to greater speed. Its use cannot with certainty be traced further back than Roman times. Rowels first appeared early in the 14th century. The spurs of mediæval knights were gilt and those of esquires silvered. "To win his spurs" meant to gain knighthood. The Mexicans and Spanish-Americans generally wear large spurs, often of silver, except the rowel, and sometimes beautifully ornamented. The tendency in North America and

Digitized by Google

western Europe is to use spurs much less than formerly.

Spurge. See EUPHORBIACEÆ.

Spurge-laurel. See DAPHNE.

Spurgeon, spėr'jŏn, **Charles Haddon,** English Baptist preacher: b. Kelvedon, Essex, 19 June 1834; d. Mentone, France, 21 Jan. 1892. He was the son of a Congregationalist minister and was educated at Colchester and Maidstone. In 1849 he was appointed usher in a school at Newmarket, and soon after engaged in religious work at Cambridge and the neighborhood, being known locally as the «boy preacher.» Having joined the Baptist body he accepted the pastorate of a small Baptist congregation at Waterbeach at 18. Becoming known for his eloquence he was called, in 1854, to the pastorate of the Baptist chapel in New Park Street, Southwark, and this, becoming too small for his audience, his congregation successively removed to Exeter Hall and the Surrey Music Hall, and ultimately built, in 1861, the great Metropolitan Tabernacle, which could accommodate 6,000 persons. Here he preached and labored for the rest of his life, his discourses attracting hearers from all parts of the world. Besides his ordinary ministrations, and the publication from 1855 of a weekly sermon, he founded the Pastors' College, at which the ministers of 36 London chapels were trained by him, the Stockwell Orphanage, almshouses, schools, etc. Earnestness, simplicity, directness, liveliness, and not infrequently a genuine touch of humor were the chief characteristics of his sermons. Sagacity, common sense, straightforwardness, hatred for sham and falsity, were prominent traits of his character as a man. He was the author of numerous volumes, among which the best-known are: 'The Saint and his Saviour' (1867); 'John Ploughman's Talk' (1868); 'Feathers for Arrows' (1870); 'The Treasury of David,' a commentary on the Psalms — extending to seven volumes (1865–80); 'Types and Emblems' (1875); 'The Metropolitan Tabernacle and its Work' (1876); 'Farm Sermons' (1882); 'The Present Truth' (1883); 'Storm Signals' (1886); 'Salt Cellars' (1889); and he edited the monthly magazine 'Sword and Trowel.' Consult 'Life' by Shindler (1892).

Spurgeon, Thomas, English Baptist clergyman, son of C. H. Spurgeon (q.v.): b. London, England, 20 Sept. 1856. He was educated at the Pastors' College, studied art, and visited Australia and Tasmania in 1877 and in 1879. In 1880–9 he was in charge of the Baptist Church at Auckland, New Zealand, and was evangelist of the New Zealand Baptist Union in 1889–93. Since 1894 he has been pastor of the Baptist Church, Metropolitan Tabernacle, London. He is editor of 'Sword and Trowel' and has published: 'The Gospel of the Grace of God' sermons (1884); 'Scarlet Threads and Bits of Blue,' poems (1892); 'My Gospel,' sermons (1902); etc.

Spurry, a plant of the genus *Spergula,* order *Caryophyllaceæ;* annual herbs, with the narrow or awl-shaped stipulate leaves fascicled at the swollen nodes of the succulent stems, and thus appear as if in whorls. The flowers are small and white in terminal, loose cymes, and have their parts in fives. *S. arvensis* is the common corn-spurry or yarr, a weakly spreading slender plant, generally glabrous, and with numerous flowers. It has been naturalized from Europe, where it is found in sandy fields, and is sometimes cultivated for green manure, and for a rapidly growing fodder, or soiling crop, well liked by cattle. It is also eaten by hens, and a lamp-oil has occasionally been extracted from its seeds. The sand-spurries are delicate plants of the closely allied genus *Tissa,* haunting salt-marshes and sea-beaches, with small pink flowers.

Spurzheim, spoorts'hīm, **Johann Friedrich Kaspar,** German phrenologist: b. Longwich, near Treves, Rhenish Prussia, 31 Dec. 1776; d. Boston, Mass., 10 Nov. 1832. He was educated at Vienna, where he became acquainted with Franz Joseph Gall (q.v.), the founder of the system of phrenology. To this study Spurzheim became exceedingly partial; and he soon joined Gall in making inquiries into the anatomy of the brain. They quitted Vienna in 1805 to travel, and went in 1807 to Paris. From that period Spurzheim traveled and lectured in England, Scotland, and Ireland. In 1832 he visited the United States and began his lectures in Boston, but death soon interrupted nis labors. He published 'The Physiognomical System of Drs. Gall and Spurzheim' (1815); 'Sur la Folie' (1818); 'Essai philosophique sur la Nature morale et intellectuelle de l'Homme' (1820); 'A View of the Elementary Principles of Education' (1821) etc. Consult: Carmichael, 'Memoir of the Life and Philosophy of Spurzheim' (1833). See also PHRENOLOGY.

Spuyten Duyvil (spī'tn dī'vĭl) **Creek,** a tidal channel connecting the Hudson River with the Harlem, and forming the northern boundary of Manhattan Island, New York. Its name is derived from the Dutch «*Spyt den duivel*» (in spite of the devil), and is supposed to have been derived from the following circumstance:— When the English fleet appeared in New Amsterdam (New York) harbor, the governor's trumpeter was sent to warn the farmers up the Hudson and summon them to the defense of the city; on reaching this creek he found no ferryman willing to take him across on account of the high wind, and swore to cross the stream «*spyt den duivel*»; but was drowned in the attempt to swim across. The creek is crossed by a railway drawbridge near the Hudson. Many fish are found in its waters, large quantities of shad being caught here every year.

Spy, a secret emissary sent into the enemy's territory or encampment to inspect their works, ascertain their strength or movements, and report thereon to the proper officer. As the service is most dangerous, for it is the custom when a spy is caught to put him to an ignominious death, a general has no right to compel any person, whether a subject of his own or the enemy's country, to undertake it. The proper business of a spy is to obtain intelligence, and he must not be employed to take the lives of any of the enemy. An officer or soldier found within the enemy's lines should not be treated as a spy if he is clothed in his own uniform, but is dealt with either as a deserter or prisoner of war; but if wearing the enemy's uniform or civil dress, he is liable to be hanged. The American Civil War offered many instances of great daring on the part of spies, Union and Confederate, and in numerous cases their ex-

Digitized by Google

ploits resulted in a tragic death. While spies are undoubtedly induced to perform their perilous work, in numerous cases, by hope of reward, yet there have also been many examples among them of pure and devoted patriotism. In the Russo-Japanese war several Japanese officers of rank and family position, who sought, in the disguise of coolies, to blow up a railway bridge in Manchuria, were promptly hanged as spies.

Spy, The, a famous romance by James Fenimore Cooper, published in 1821. It was immediately successful and has been vary widely read, not only in English but in various European languages. The time of the tale is about 1780 and the scene southeastern New York.

Squad, in the army, a small body of troops assembled for drill, inspection, or other purposes. A troop of cavalry or a company of infantry is usually divided into as many squads as there are sergeants or drill-instructors to train them. The awkward squad is composed of those recruits who have not received sufficient training to take part in regimental drill.

Squad'ron, (1) the principal division of a cavalry regiment. This body is subdivided into two troops. Three or four squadrons form a regiment. When in line one yard in the length of the front is allotted for each man and horse; the space in line between every two squadrons is equal to one quarter of the extent occupied by each squadron. (2) In the navy a squadron is a number of vessels employed on any particular service or station, under the command of a commodore or junior flag-officer.

Squarcione, Francesco, frăn-chĕs'kō skwär-chē-ō'nē, Italian painter: b. Padua 1394; d. there 1474. In early life he traveled in Greece and Italy, where he became acquainted with the masterpieces of ancient sculpture. He formed a collection of busts, torsos, and bas-reliefs (probably casts) and founded the Padovan school of painting, which produced Mantegna and Zoppo. One of his latest works is 'A Madonna and Child,' now in the possession of the Lazzard family at Padua.

Square, (1) in geometry, a quadrilateral figure, both equilateral and equiangular, or, in other words, a figure with four equal sides and equal angles. In measuring superficial areas it is only necessary to multiply one side by itself to have the area of the square, because each of the sides may be considered as the basis or as the perpendicular height. Thus a square the sides of which measure 4 feet is equal to 16 square feet, that is, 16 squares each 1 foot high and 1 foot long. To square a figure (for example, a polygon) is to reduce the surface to a square of equivalent area by mathematical means. It has often been attempted to square the circle, but this cannot be done. (2) In arithmetic and algebra the square of a number is the number or quantity produced by multiplying a number or quantity by itself. Thus 64 is the square of 8, for $8 \times 8 = 64$. (3) In military tactics, a body of infantry formed into a rectangular figure with several ranks or rows of men facing on each side, with officers, horses, colors, etc., in the centre. The front rank kneels, the second and third stoop, and the remaining ranks (generally two) stand. This formation is usually employed to resist a cavalry charge. Hollow squares are frequently formed with the faces fronting inward when orders and instructions, etc., are to be read, and the like.

Squaring the Circle. See Quadrature.

Square Root. *Arithmetical.*—The square root of a number is one of its two equal factors. It is indicated by the fractional exponent (½) placed at the right, and above the number, thus $16^{\frac{1}{2}}$, or by the radical sign ($\sqrt{16}$). The two equal factors of 16 are 4 and 4, either one of which may be taken as its square root. The square roots of many numbers are approximate only, and are represented by a whole number and a decimal, the latter carried out as many places as the approximation is desired, as example, $\sqrt{19} = 4.358899+$. The square root of fractions may be found by extracting the root of the numerator and denominator, but a more practical method is to extract the root of the resulting decimal. Illustration of the method employed in finding the square root of 576:

$$\begin{array}{rl} & 576\,(20 \\ 20 = & 400 \quad 4 \\ & \overline{} \quad \overline{} \\ 2 \times 20 = 40) & 176 \quad 24 \\ (40 + 4) \times 4 = & 176 \\ & \overline{} \end{array}$$

Since the number 576 has three figures its square root will be composed of tens, and units. The number of tens in the root will be 2, and the square of 2 tens, or 20, will be 400. (See

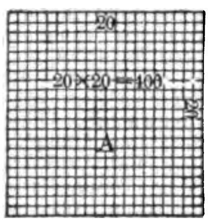


Fig. 1.

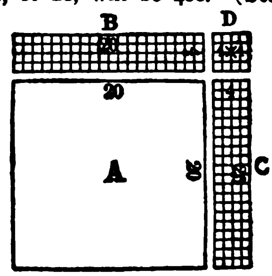


Fig. 2.

Fig. 1.) But inasmuch as there is still a remainder of 176, such additions must be made to the square as will take up this remainder, and still keep the figure a perfect square. The necessary additions are the two rectangles B and C and the small square D (see Fig. 2). The remainder 176 divided by the length of the rectangles, 2×20, will give the width of the additions, which is 4, and this width is also the side of the small square D; therefore the total length of the additions will be $40 + 4$, and the area of the additions 4 times this length, or 176, which completes the square whose area is 576, and whose square root is 24.

Algebraic.— The preceding rules, with the exception of those relating to decimals, are applicable to algebraic quantities. The square root of an algebraic quantity, however, may be positive or negative.

The square root of a negative quantity is imaginary, and is usually factored into two quantities, one of which is real, and the other expressed by $\sqrt{-1}$. Thus the square root $\sqrt{-ab} = \sqrt{ab}\,\sqrt{-1}$.

The square root of algebraic quantities affected by other roots is indicated by multiplying its exponent, or index by 2, wherever possible

Digitized by Google

the square root is first extracted, and the multiplication avoided.

The indicated square root of an imperfect square, in algebra, is called a quadratic surd. To extract the square root of a binomial surd, such as $\sqrt{a+\sqrt{b}}$, there are many methods; one is to reduce the surd term so that its coefficient shall be 2. Then separate the rational term into two parts whose product shall be the quantity under the radical sign. Extract the square roots of these parts, and connect them by the sign of the surd term.

Square root finds its application in all branches of mathematics, and in the natural sciences. Its use is fundamental.

Squash, a garden vegetable, the fruit of several species of the genus *Cucurbita* (order *Cucurbitaceæ*). They are vine-like tendril-bearing herbs, with large rough leaves on long hollow stalks, have large monœcious yellow flowers borne singly in the axils of the leaves, and followed by hard fruits of many forms and sizes. They are natives of warm climates, but are cultivated as annuals in temperate regions throughout the worla. The summer squashes are derived from *C. pepo* mainly, and the winter kinds principally from *C. maxima,* though *C. moschata* also enters into many varieties. The first species, which is also parent of the pumpkin (q.v.), has given rise to the scallop, pattypan, and summer crookneck squashes, the first known in southern markets as simlins, symblings, and various similar names; the third is the parent of the winter and Canada crookneck, China and cushaw squashes. *C. moschata* and *C. pepo* have been crossed artificially, but none of these species are known to cross under field conditions, and the other pairs among these three species have not been crossed artificially.

Squashes thrive best in long seasons, in warm situations, and upon light, loamy but only moderately rich well drained soils. In the North they are often planted too early and are injured by late spring frosts, and they often fail to mature all their fruits because the early frosts of autumn injure the vines. To obviate these results the plants are frequently started under glass upon pieces of sod or in pots, and are transplanted to the field when seeds could be safely planted. About three weeks is the maximum time to allow between sowing and transplanting, the plants being likely to be too large for best results if older. The soil should be deeply and finely prepared, and marked off in checks prior to sowing. For «bush» and summer squashes 4 x 4 feet is the usual distance; for winter and viny kinds 8 or 12 feet. Most growers allow only two or three plants to each «hill,» but plant 12 or even more seeds in the hills to guard against contingencies. The ground is kept cleanly cultivated until the vines prevent tillage. In the North the vines should not be allowed to root at the joints because this prolongs the vegetative period, and here if one fruit sets long in advance of others upon a vine it is usually cut off since other fruits often fail to form. Two or three squashes are usually calculated upon per vine for winter varieties; summer kinds will often continue to bear until frost if the fruits are removed as soon as they attain edible size. Winter squashes may be successfully stored for several months but they should be gathered before frost, handled with extreme gentleness to avoid the slightest bruise even to the hardest specimens, and kept at a rather low temperature in a dry atmosphere until needed for use.

Several insects feed upon the squash and sometimes prove troublesome when very abundant. Probably the best known of these is the squash bug (*Anasa tristis*) which appears from its hibernating quarters about the time the earliest plants appear. The eggs are laid upon the foliage and in about a week the scarlet larvæ emerge. They pierce the tissues with their stout beaks and suck the juices, and as they grow they turn gray, becoming dark brownish gray when mature. The adults are about a inch long and there is a seemingly constant succession of over-lapping broods from midsummer onward, insects in all stages of development being found. There are, however, in the North usually only two broods. The plan found most satisfactory in controlling these insects is destruction of the vines and immature fruits as soon as the crop can be gathered in the autumn. The squash vine borer, the squash lady-bird beetle, the cucumber beetle, and several other insects also feed upon the squash. See Cucumber; Melon; etc.

Squaw-berry, the squaw-huckleberry or deerberry, *Polycodium* (*Vaccineum*) *stamineum,* a small ericaceous shrub, found in dry woods, with oval leaves, and pretty greenish flowers. These have spreading bell-shaped corollas, and droop on long pedicels from the leaf-axils of slender branches, as if in a leafy raceme. The berries are large, globose, or somewhat pear-shaped, green and spotted when young, but ultimately turning to purple, or almost black. They are inedible.

Squaw'fish, a very large chub (*Ptychocheilus oregonensis*), 2 to 4 feet long, which is abundant in the rivers from British Columbia to central California, where it is known as Sacramento pike. It is silvery greenish in color, and is used as food. In the same genus is found the largest of American cyprinoids, the «white salmon» of the Rio Colorado (*P. lucius*), which may weigh 75 pounds or more.

Squat'ter, the name given a person who settles on public or new lands without any title. In Australia the sheep-farmers, who occupy the unsettled tracts of land as sheep-runs under lease from government at a nominal rent, are also called squatters.

Squatter Sovereignty, a term designating the right of occupation acquired through undisturbed possession of public lands for a certain number of years, by unauthorized settlers.

Public lands or public domain belonging either to the nation or individual States, from the necessities of government and the usual operations of capitalists, became an object of speculation, and were accordingly sold from time to time in large tracts to capitalists and speculators, who generally resided at a great distance from the lands thus purchased by them. Their lands being thus entirely out of their view and control, were of course continually intruded upon, and possession taken here and there by emigrants from the more populous towns, who put them under cultivation, and erected houses and buildings upon them for the common purposes of agriculture. These settlers came to be familiarly known as squatters.

Digitized by Google

a name naturally derived from the act of settling upon lands in the manner practised by them. By the lapse of time the mere possession of these settlers, without any legal title to the land, ripened into what they considered to be a right, although the proprietors of the soil were in general wholly ignorant of such occupation of their property. At length, after a long series of years, it became impossible to dispossess them, however wrongful their possession, in its origin, may have been. It is true that the proprietors might, and did institute legal processes, and recovered judgment against the occupants, but the officers of justice could not execute the sentence of the law and dislodge them from their possession. Instances not unfrequently occurred where the officers of justice and the proprietors themselves, or their agents, were shot at, or suffered other acts of violence from the occupants. In this critical exigency, which threatened so much mischief to the public as well as individuals, and which was perhaps exaggerated by those men who wished to avail themselves of the occasion to obtain popularity for political purposes, it was thought necessary to pass laws which were to a great extent similar to the Roman agrarian laws and which deprived the real proprietor of a portion of his rights and transferred them to the wrongful possessor of the lands sold by the public.

Under colonial laws and usages a title to land by mere occupancy could not be acquired by a possession short of 60 years. By one of the first laws promulgated by a State of the republic on the question, the legislature of Massachusetts in 1808 shortened this term to 40 years. So far as it affected those persons who had previously purchased either of the State or of others holding under the State, its operation was manifestly unjust. It compelled the proprietors to relinquish at once their claim to all that portion of their lands which they had been dispossessed of for more than 40 years, and which they had purchased at the full value under the faith of the ancient law of 60 years' possession.

This essential change in the legal rights of the proprietors in violation of what they deemed to be the fair intent and meaning of their contracts, caused much excitement and dissatisfaction among them. Generally, it may be said that there evidently was a hardship on both sides; it was not equitable on the one hand, that the proprietor should be deprived of his land, nor on the other that an innocent occupant, who had been suffered to remain in possession for 30 or 40 years, undisturbed by the proprietor, should be suddenly expelled and stripped of the fruits of the labor of a whole life. By way of alleviating the difficulties of the case, it was provided in this law of 1808 agreeably to a well-known principle of the Roman code, that when the proprietor should institute a process to recover his land, the occupant should have a right to claim an allowance for the value of the improvements which he had made upon the lands thus occupied by him, and which were called in the Roman law *meliorantes* or *melioramenta*, and by analogy in the popular language of New England, *betterments, improvements*, which might have been taken to convey the idea of *melioramenta* being already used in New England in the sense of occupation.

In practice the law was more unequal in its operation as regarding the proprietor of the land from another circumstance; for he being usually a non-resident or stranger, and the occupant being an inhabitant of the same territory from which the jury was taken who were to try the question of right between the parties, the proprietor was in the more danger of suffering injustice from the prejudice or hostility of the jury. But here again the law interposed a useful check which was that no person who was interested in a similar question should be a member of the jury.

Notwithstanding the presumable injustice of the law, it remained in operation, and the lapse of time rendered it less and less unequal and injurious in its effects; it became the model of similar laws for all other States of the Union which respectively claimed the right to legislate upon the matter according to local needs.

And from this claim for legislation according to local needs arose the cry of «popular sovereignty» which became identified with «squatter sovereignty» in that its adherents, especially from 1847 to 1861 advanced and strenuously advocated the theory that the question of slavery in a State or Territory should be decided by the electorate of the State or Territory and not by Congress. See also LANDS, PUBLIC; PUBLIC DOMAIN.

Squaw-berry, or **Squaw-huckleberry,** the deerberry, genus *Vaccinium stamineum,* a bush native to the eastern part of the United States. The bush rarely grows to any height and the berry is very unsavory. The bush, however, has pretty racemed flowers with white recurved corolla and yellow stamens.

Squawfish, a fish of the genus *Ptyochelus oregonensis,* inhabiting the fresh water bodies in California, and commonly known there as the «Sacramento pike.» It grows sometimes to be five feet in length and is one of the largest specie of the carp family to be found in American waters.

Squawroot, skwâ'röt, a fleshy plant, genus *Conopholis americana,* of the order *Orobanchaceæ,* native of the eastern part of the United States. It is generally root-parasitic and found among fallen leaves in oak woods. It is leafless, grows to a height of three to six inches and as large around as a man's thumb. Fleshy scales entirely cover the plant and the flowers are in axils of these scales. The blue cohosh, *Caulophyllum thalictroides,* is in rare instances also called squawroot.

Squaxon. See SALISHAN INDIANS.

Squeteague, skwĕ-tēg'. See WEAKFISH.

Squid, any ten-armed cuttlefish (q.v.; also CEPHALOPODA), not a sepia or spirula (q.v.). The squids are divisible into several groups, and range in size from less than an inch (*Idiosepion*) to 75 feet or more in length, when the arms are outstretched. They are found in all oceans, and most of the genera are nearly cosmopolitan. The small families *Sepiadariidæ* and *Idiosepiidæ* are confined to the Pacific, and the *Chiroteuthidæ* to the Atlantic, but the others are practically world-wide in their distribution and pelagic as well as littoral in range. Together these families form the dibranchiate suborder *Decapoda.* Most of the squids belong to the shore-haunting *Loliginidæ* or else to the pelagic family *Ommastrephidæ.* In both the gladius, «pen,» or

Digitized by Google

"cuttlebone," is long and chitinous instead of broad and calcareous as in the sepias proper. The old European names "calamary" or "pen-and-ink fish" refer to the pen-shape of this internal support, which is nearly or quite as long as the back; and to the reservoir of inky dye which they discharge when alarmed. In the *Loliginidæ* it is flat, pointed in front, and has the shaft keeled on the ventral side; in the *Ommastrephidæ*, it is horny, narrow, and terminates in a hollow cone at the posterior end. There are many species, both existing and fossil.

The common squid of the North Atlantic coast of the United States is *Loligo pealii*, which after several years of slow growth become 12 to 18 inches long. The color when living is very changeable, owing to the alternate contraction and expansion of the color-vesicles (chromatophores, q.v.), but red and brown tints prevail, and the general effect is great beauty. These squids lay their eggs in midsummer in large bunches of long gelatinous capsules on shelly and weedy bottoms and along rocky coasts. This species is often found in great numbers in summer close to the shore of Maine and northward, and many of them are stranded on the beaches. All the squids are caught by sea fishermen to use as bait.

The "flying squids" of the genus *Ommastrephes*, are so named from their habit of leaping from the sea, sometimes to such a height as to land them upon the decks of vessels. They are met with chiefly far from land; but one small species (*O. illecebrosa*) is frequently seen in large companies near the New England coast. Verrill describes its attack upon schools of small fishes in which it resembles squids generally. All the species are fish-eaters, and are themselves the prey of larger fishes, and of porpoises and the various whales, turtles, etc., of the sea. "In attacking the mackerel," says Verrill, "they would suddenly dart backward among the fish with the velocity of an arrow, and as suddenly turn obliquely to the right or left and seize a fish, which was almost immediately killed by a bite in the back of the neck with the sharp beaks . . . cutting out a triangular piece of flesh." They are mainly nocturnal in activity.

To this family belong the "giant squids" of the genus *Architeuthis*, which occur in Arctic and sub-Arctic seas, and are occasionally stranded on the shores of Norway and Greenland, or found in part in the stomachs of captured sperm whales, for which they form an important food-resource. These giants, which probably reach a great age, and frequently exceed 50 feet in length, including the arms, have such strength that they would drag down a large boat, if given an opportunity, and cases are known where men in the water, seized by even small specimens, have escaped with great difficulty. Preserved remains and papier-maché models may be seen in the museum of Yale University.

Consult: Cooke, 'Mollusca' (London 1895); Kingsley, 'Standard Natural History,' Vol. I. (Boston 1885); Verrill, 'Invertebrates of Vineyard Sound' (Washington 1874).

Squier, skwīr, Ephraim George, American archæologist: b. Bethlehem, N. Y., 17 June 1821; d. Brooklyn, N. Y., 17 April 1888. He engaged for a time in teaching, was connected with the village newspaper, and studied engineering. He was employed on the 'New York State Mechanic' in 1841, and in 1843 went to Chillicothe, Ohio, where he was on the staff of the 'Scioto Gazette' and also clerk of the legislature. Soon after removing to Ohio he began a series of investigations concerning the ancient mounds in Ohio and the neighboring States. In 1849 he was *chargé d'affaires* to the Central American States, was secretary of the Honduras Interoceanic Railway Company there in 1853, in 1863–5 he was United States commissioner to Peru, and appointed consul-general to Honduras in 1868. While performing the duties of these various offices he prosecuted an extensive series of researches and became generally recognized as the principal authority on American Indian archæology. He was afterward chief editor of Frank Leslie's publications and in 1871 was active in organizing the American Anthropological Society of which he was the first president. A severe illness in 1874 incapacitated him for further research, though he recovered sufficiently to complete the revision of his work on Peru. His publications include: 'Ancient Monuments of the Mississippi Valley' (1848); 'Aboriginal Monuments of the State of New York' (1851); 'Serpent Symbols' (1852); 'States of Central Peru' (1861); 'Peru: Incidents and Explorations' (1877); etc.

Squill. See SCILLA.

Squilla. See CRUSTACEA; MANTIS-SHRIMP.

Squint, in architecture, an oblique opening passing through the walls of many old churches, usually constructed for the purpose of enabling a person in the transepts or aisles to see the elevation of the host at the high altar. Generally they are not above a yard high and 2 feet wide, but sometimes they form narrow arches 10 or 12 feet in height.

Squinting. See VISION, DEFECTS OF.

Squire, or **Esquire,** (1) formerly an attendant on a knight; a knight's shield or armor-bearer. (2) An attendant on a person of noble or royal rank; hence, colloquially, an attendant on a lady; a beau, a gallant; a male companion, a close attendant or follower. (3) The title of a gentle next in rank to a knight. (4) A title popularly given to a country gentleman. (5) A title given to magistrates and lawyers in the United States. In New England it is given especially to justices of the peace and judges; in Pennsylvania to justices of the peace only.

Squirrel, a typical member of the rodent family *Sciuridæ*, to which the woodchuck (q.v.) and other marmots also belong as the sub-family *Arctomyinæ*. The squirrels form the sub-family *Sciurinæ*, the members of which are of slender form and have long bushy tails. All of the squirrels have well-developed clavicles and the two bones of the lower leg well-developed and distinct; the premolar teeth are two above and one below, but the first upper one is small and usually deciduous; the molars, three in each jaw, broad, tuberculate, and rooted; the incisor teeth are compressed and the palate broad. About 15 genera with very numerous species and sub-species are distributed throughout the world except in Australia. The typical species are diurnal and strictly arboreal, but some of the ground-dwelling species are transitional to the terrestrial and burrowing marmots and some are nocturnal. They are

Digitized by Google

chiefly vegetarian, but differ much in the exact nature of their food; most of them partake more or less of an animal diet and many habitually rob the nests of birds of both eggs and young. In cold and temperate climates most species hibernate more or less completely and gather stores of nuts, grains, and other foods for the winter months. Some species are known to migrate occasionally in large numbers. The species are of small or moderate size, the largest equaling a cat and the smallest a mouse. Squirrels are adaptable creatures and live under a great variety of climates and conditions, the two principal centres of development being regions physically so different as the Malayan Islands and North America, in the latter of which five genera and 120 species occur.

The typical genus *Sciurus* includes species mostly of proportionately large size with magnificent bushy tails, no cheek-pouches, the thumb rudimentary and without nail, and the first upper premolar absent or minute. Of the 75 species, approximately, of this genus, fully one half are Oriental. Few native mammals are better known or more beloved than the gray squirrel (*S. carolinensis*), sometimes called the cat squirrel, and, in its melanistic phase, the black squirrel. It abounds in hardwood forests from Canada to Florida and westward to Minnesota, and in the lowlands as well as the mountainous districts. As might be expected from this wide range, it splits into a number of distinct races. This species reaches a length of abount 20 inches, of which the tail is nearly one half, and more rounded and bushy than in any other species. The eye is large, full, and bright, the ears erect and pointed, but not tufted, and the color rusty gray above, more or less brown along the back and paler below. In the parks and more open parts of even large cities, wherever suitable trees supply a home and a refuge from cats and dogs, the gray squirrel has become semi-domesticated.

Its active arboreal habits and sprightly appearance have done much to make the squirrel the admitted type of frolicsomeness and sport. The food consists of nuts, acorns, seeds, fruits, etc., and these animals evince economic and frugal habits, in that they accumulate during the autumn a store of provisions, which is deposited in the nooks and crannies of trees. The nest and dwelling-place consists of a spherical structure formed of intertwined twigs with attached leaves lined with leaves and bark and is generally placed in the fork of a bough, in an inaccessible situation in the top of a tall tree. Cavities in trees are similarly lined and serve as nurseries and shelters in which to hibernate. The squirrels exhibit a great attachment for their respective nests, one pair generally occupying the same tree and nest for a long period. From three to four young are produced at a birth, usually in June, the young remaining in the parent nest until the following spring. When engaged in eating, these animals grasp the nut or other food in their fore-paws, sitting meanwhile on their haunches, and gnawing off, by aid of their powerful teeth, the hard outer coverings, and even peeling the kernel before eating it. The bushy tail of the squirrel, besides serving, when folded round the body, to retain the heat, assists through its outspread hairs in supporting the animal in its aerial leaps, a function subserved in other squirrels by special developments of the skin.

Before the deforestation of this country had destroyed so many of its natural haunts this species was extremely abundant and not only sometimes raided cultivated fields to the great loss of the farmer, but sometimes migrated in great numbers, even crossing large rivers like the Ohio. Squirrel shooting is a favorite pastime with many, and were it not for the destruction which it entails of such lovable and sprightly animals could be commended as one of the pleasantest of sports, the pursuit of which takes one into forests of noble old trees in the most exhilarating season of the year. It necessitates long cross-country walks without the assistance of a dog, and requires a quick eye and steady hand to bring down the alternately appearing and disappearing game as it leaps and bounds among the topmost branches or projects itself through space from tree to tree. The practice of the Kentucky pioneers of «barking» squirrels has been too often graphically described by Audubon and others to require more than a passing comment.

The fox squirrel (*S. rufiventer*), which now inhabits almost exclusively the pine forests of the Southern States, is a large species. The body is 14 inches in length, and the tail 12. The color is usually a rusty gray or clay color, whitish below and tending on the tail to rufous, margined with black; the top of the head black and the nose and ears white. The colors are, however, exceedingly variable, ranging from gray to deep black. The tail, though large, is less bushy, flatter, and the hair coarser than in the gray squirrel. Some of the varieties of the fox-squirrel extend northward through the mountains to New York and westward to the Dakotas, but have been nearly exterminated in most places and none are quite so large as the typical southern race. In general the habits of the fox-squirrel differ little from those of the gray squirrel, but in the South at least it does not hibernate nor store food, which consists largely of fruits, green corn, etc. Because of its large size it is much sought for food by the natives.

Of all our squirrels the most abundant and best known in the northeastern United States is the red squirrel or chickaree (*S. hudsonicus*) which, like the others, splits into several sub-species and with related western species occupies British America and the northern half of the United States. In the east the high mountains of North Carolina are the southern limit of its range. The body is eight and the rather thinly haired tail six inches long, the color bright rusty red above, yellowish gray to light gray on the sides and below. Of all the squirrels this species is the most active, noisy and mischievous, constantly tearing over the ground and through the trees, playing, quarreling, and chattering with its fellows. In most places it continues active throughout the winter. It breeds and sleeps in warm, lined nests in hollow trees or old nests of crows and other large birds roofed over with twigs, leaves, and bark of grape vines, etc.; they also have burrows, used partly as retreats, partly as one of their numerous storehouses for food. Besides nuts, etc., red squirrels feed largely upon the

Digitized by Google

seeds of spruce and hemlock cones which they extract with great skill; and they are inveterate robbers of birds' nests, as well as of the farmers' corn cribs. A remarkable fact is that, though so much inferior in size, this species frequently expels the gray squirrel from certain areas, and it is true almost everywhere in the New England and Middle States that the former is increasing and the latter decreasing in numbers.

The ground squirrels (*Tamias* and *Eutamias*) are provided with a pair of large cheek pouches and a well-developed nail on the thumb. The skull is relatively light and narrow, the first upper premolar minute or absent, the tail small and little bushy, and the colors striped. The species and races are numerous, all but one Eurasiatic species being North American. The eastern chipmunk or ground hackee (*T. striatus*) is abundant everywhere in open woods from New England to Georgia, a distinct variety replacing it farther north.

Spermophilus is a genus, represented by numerous species in western North America and one in northern Asia and Europe, transitional between the ground squirrels, which they closely resemble in appearance and habits, and the marmots. Indeed they are ordinarily called striped marmots and by some zoologists are placed in the family *Arctomyinæ*. They all have large cheek pouches, well developed upper premolars, and usually short tails; but vary greatly in colors and their pattern. *S. tridecemlineatus* is marked with six light longitudinal stripes alternating with seven rows of white dots on a brown ground. It is an abundant species on the prairies as far east as Illinois.

Lastly come the flying squirrels, the American species of which belong to the genus *Sciuropterus*. In the absence of cheek-pouches and some other features of their organization these remarkable animals more closely resemble the typical squirrels than the ground-squirrels, but depart widely from these and all other North American mammals in the possession of a densely hairy fold of skin extending along the sides and connecting the fore and hind legs, forming a parachute which, when extended, supports the animal on its flying leaps from tree to tree. The tail also assists in this function, the dense fine fur spreading at the sides like the vane of a feather. The common species (*S. volans*) is found throughout the eastern half of the United States north to Maine, where it is replaced by a distinct species. See FLYING SQUIRREL.

The squirrels of Europe in general resemble ours, but are less numerous. Many of the African, and especially those of Borneo and neighboring islands, are remarkable for their large size, conspicuously striped fur, tufted ears, or other peculiarities.

Consult: Allen, 'Bull. Geol. Geog. Sur. Territories,' Vol. IV. (Washington 1878); Allen, 'North American Arboreal Squirrels,' 'American Naturalist,' 1899; Bailey, 'Prairie Ground Squirrels,' Bull. Biological Soc. of Washington, 1893; Stone and Cram, 'American Animals' (New York 1900).

J. PERCY MOORE,
University of Pennsylvania.

Squirrel-corn, or **Turkey-corn**, a delicate, succulent, papaveraceous plant (*Bicuculla canadensis*), found in rich woods in North America. It has much dissected leaves, glaucous beneath, rising from the ground, and simple scapes from which depend the peculiar, cordate-ovate corollas in racemes, each flower with four petals, the two outer oblong and concave, with short rounded spurs at the base, and parted at the other end to show the much crested coherent tips of the other two. They are greenish-white tinged with rose-color, and are fragrant. The perennial rootstalk is creeping and bears many small yellowish tubers, scarred by fallen petioles, which have suggested the common names, and also that of turkey-corn.

Squirrel Hake. See HAKES.

Squirrel-monkey, a small American monkey of the genus *Chrysothrix*. These are active, tree-hunting, gentle little creatures, with long, rather bushy and squirrel-like tails and tufted ears, and are lively and affectionate as pets. A widely familiar species is the Brazilian (*C. sciurea*), which is grizzled gray, with whitish paws and the tail black at the tip.

Squirrel-tail Grass. See GRASSES OF THE UNITED STATES.

Srinagar, srĭ-na-găr', or **Serinagur**, sĕr"ĭ-na-goor' (signifying «Holy City»), capital of Cashmere, or Kashmir (q.v.), in the beautiful valley of the same name, on the Jehlam River, occupies a lofty position, about 5,000 feet above sea-level. It extends about two miles along the river, which, with its windings, and the numerous vessels plying upon it, has a very picturesque appearance, but the surrounding low marshes make the climate unhealthful. It is poorly fortified, although commanding a site which permits of making it a great stronghold. Its wooden buildings are often destroyed by fire, and few of them deserve notice. The Jama Musjid, or Great Mosque, celebrated mostly for its enormous dimensions, has a rude dome and spire; another mosque of wood is curiously Chinese in character. There are numerous gardens, and a beautiful lake east of the town marks the scene of Moore's 'Lalla Rookh.' Srinagar manufactures attar of roses, shawls, leather, paper, firearms, etc.

Staal de Launay, stăl dā lō-nā, **Marguerite Jeanne Cordier**, BARONESS DE, French author: b. Paris 1693; d. there 16 June 1750. She was the daughter of a poor painter named Cordier, was brought up at the convent of Saint Louis at Rouen, and adopted her mother's name, De Launay. In 1711 she entered the service of the Duchess du Maine as *femme de chambre*. Not long afterward she became amanuensis and companion to the duchess and remained in her household for many years. In 1718 she was implicated in the Cellamare conspiracy and was sent to the Bastile for two years. In 1735 she was married to Baron de Staal. Her 'Mémoires' appeared in 1755 and it is as the author of those frank and lively pictures of the humors of the «court of Sceaux» that she is known to posterity, though she wrote also two comedies and some letters, which latter were published in 1806. Consult Sainte Beuve, 'Portraits Littéraires.'

Stabat Mater, stā'băt mā'tĕr («The Mother stood»), first words, and title of a celebrated hymn on the Crucifixion; its authorship is assigned to Jacopone da Todi, a disciple of Saint Francis de Assisi, in the 13th century. It has been set to music by several of the great composers, includ-

Digitized by Google

ing Palestrina, Pergolesi, Haydn, Rossini, and Dvorak. The composition of Pergolesi, for two voices with accompaniment, is the most celebrated, but that of Rossini is the most popular in the concert room. The hymn as given in the 'Breviarium Romanum' office of the festival of the Seven Dolors of the Blessed Virgin Mary (Friday after Passion Sunday) is as follows:

Stabat mater dolorosa,
Juxta crucem lacrymosa,
Dum pendebat filius.
Cujus animam gementem,
Contristatam et dolentem
Pertransivit gladius.
O quam tristis et afflicta
Fuit illa benedicta
Mater Unigeniti.
Quæ mœrebat et dolebat
Pia mater, dum videbat
Nati pœnas inclyti.
Quis est homo qui non fleret
Christi matrem si videret
In tanto supplicio?
Quis non posset contristari,
Piam matrem contemplari
Dolentem cum filio.
Pro peccatis suæ gentis .
Vidit Jesum in tormentis,
Et flagellis subditum;
Vidit suum dulcem natum
Moriendo desolatum,
Dum emisit spiritum.
Eia mater, fons amoris,
Me sentire vim doloris
Fac, ut tecum lugeam.
Fac ut ardeat cor meum
In amando Christum Deum
Ut illi complaceam.
Sancta mater, istud agas,
Crucifixi fige plagas
Cordi meo valide.
Tui Nati vulnerati,
Tam dignati pro me pati,
Pœnas mecum divide.
Fac me tecum pie flere,
Crucifixo condolere,
Donec ego vixero.
Juxta crucem tecum stare,
Et me tibi sociare,
In planctu desidero.
Virgo virginum præclara,
Mihi jam non sis amara,
Fac me tecum plangere;
Fac ut portem Christi mortem,
Passionis fac consortem
Et plagas recolere.
Fac me plagis vulnerari,
Fac me cruce inebriari.
Et cruore filii.
Flammis ne urar accensus,
Per te, Virgo, sim defensus
In die judicii.
Fac me cruce custodiri,
Morte Christi præmuniri,
Confoveri gratia.
Quando corpus morietur,
Fac ut animæ donetur
Paradisi gloria.

Stabillite. This new smokeless powder, invented by Hudson Maxim, in recent tests made in cannon both large and small, has given far higher ballistic results than have ever heretofore been obtained by other powders anywhere in the world. "Stabillite," furthermore, possesses the great advantage that no volatile matter is employed in its manufacture, and consequently it requires no drying after manufacture, but is ready for use immediately. For this reason it undergoes no change whatever by keeping for any length of time.

Stachys, stā'kĭs, a genus of perennial and annual herbs and a few shrubs of the order *Labiatæ*. The species, of which there are about 150, are natives of mild climates. They have simple, opposite leaves, small, white, yellowish, red or purple flowers in axillary whorls or terminal spikes. They are mostly found in low moist ground, but though several are attractive when in flower they are little cultivated.

Sta'dium, a Greek measure of 125 paces, or 625 Roman feet, equal to 606 feet 9 inches English; consequently the Greek stadium was somewhat less than our furlong. It was the principal Greek measure of length. This term was also applied to the course for foot-races at Olympia in Greece, which was exactly a stadium in length. The name was also given to all other places throughout Greece wherever games were celebrated.

Stadtholder, stăt'hōl"dėr, a title given in the Netherlands to a governor of a province who was also commander-in-chief of the forces. This title, however, received its special significance in 1580, when the provinces of Holland and Zealand revolted against the authority of Spain, and unitedly accepted William, prince of Orange, as their stadtholder. The prince was assassinated before he was formally invested with this office, but the title was conferred on his son, Prince Maurice, and remained as the hereditary title of the chief of the state until Holland was annexed by France in 1802. This title was finally dropped in 1814, when the Prince of Orange was recalled from England and declared king of the Netherlands by an assembly of notables.

Stael-Holstein, stä'ĕl-hŏl'stīn (Fr. stäĕl ŏl-stăñ), **Anne Louise Germaine Necker,** Baroness de, French author: b. Paris 22 April 1766; d. there 14 July 1817. She was the only child of Jacques Necker, Swiss banker and minister of finance to Louis XVI. Necker's house was the resort of the most distinguished men of the capital; every week on a certain day were assembled in the *salon* of Madame Necker the most eminent scholars of the day, as Marmontel, Raynal, Grimm, Thomas, etc. The encouragement the young girl received in this society, and the various excitements which it furnished to her faculties, had an important influence on the formation of her mind. To these she owed that rare conversational power for which she was so remarkable, with that inclination to ingenious, brilliant, and striking theories, which appears in her earlier works. Her earliest productions were 'Sophia,' a comedy (1786), and two tragedies, 'Lady Jane Grey' and 'Montmorency.' Her 'Lettres sur les Ouvrages et le Caractère de J. J. Rousseau' (1788), first attracted the public notice. In 1786 she was married to the Baron de Staël-Holstein, Swedish ambassador at the French court, a man much older than herself, whose suit was favored by Madame Necker's desire that her daughter should marry a Protestant.

The breaking out of the Revolution (1789) exercised a powerful influence both on her mind and fate. The first period of her father's service in the ministry (1777–81) brought his family into connection with the great world and public affairs. During Robespierre's ascendency she exerted herself to save the victims, and published a powerful and eloquent 'Defense of the Queen.' After the insurrection of 10 Aug. 1792 she fled in September to her father's house at Coppet in Switzerland, which now became the refuge of the French fugitives. When Sweden recognized the French republic, her husband was again sent as ambassador to Paris, whither she returned in 1795. The government of the Directory gave her

Digitized by Google

an opportunity of effecting the recall of some of the emigrants. Barras became her friend; and she acquired so much influence that, on Talleyrand's return from America in 1796, she obtained, through Barras, his appointment to the ministry of foreign affairs. To this period also belong two political pamphlets, 'Sur la Paix' and 'Sur la Paix intérieure,' which contain her views respecting the situation of France in 1795, and express the remarkable opinion that France could arrive at limited monarchy only through military despotism. In 1796 appeared her 'De l'Influence des Passions sur le Bonheur des Individus et des Nations,' which, though characterized by enlightened views, does not contain any complete exposition of the subject. Her connection with her husband, who died in 1802, whose tastes were different, and whose talents were inferior to hers, had been from the first marked by coldness; and when she became desirous of securing the property of their children from the effects of his lavish habits, a separation took place; but his infirmities rendering the services of his friends necessary to him, she again joined him. Bonaparte she saw for the first time in 1797, on his return to Paris, after the peace of Campo-Formio. His brilliant reputation excited her admiration, but this soon gave way to fear and aversion. The danger which threatened Switzerland led her back to Coppet; but when Geneva was incorporated with France she hastened back to Paris, to cause her father's name to be struck from the list of emigrants. But some observations of Necker in his 'Dernières Vues de Politique et des Finances' (1802) offended the first consul, who caused the work to be attacked in the journals.

Madame de Staël was banished to a distance of 40 leagues from Paris, under pretense that she had given her father false information of the state of France. During her banishment she lived with her father at Coppet, but spent much time in traveling. Her literary reputation was meanwhile increased by her 'De la Littérature considérée dans ses Rapports avec les Institutions sociales' (1802), and her 'Delphine' (1802). The former attracted many assailants, among whom Fontanes was the ablest and acutest. Her romance 'Delphine' contained a faithful picture of herself as she was in her youth — separated from the multitude by genius and sensibility, and struggling against the restraints of custom and her sex. In 1803 she made a visit to Germany, and lived for about a year in Weimar and Berlin. She paid a visit to Italy in 1805, and the fruit of her journey was 'Corinne ou l'Italie' (1807), which combines in a happy manner the charms of romance with a faithful picture of Italy. It was finished in France, and was no sooner published than she was ordered to quit this country, upon which she returned to Coppet. Here she wrote 'Essais dramatiques,' and finished (1809) her work on Germany ('De l'Allemagne'). She then went to France to get it printed, but before it could be published the printed copies were seized by the police, and she was ordered to quit France. It first appeared entire at London in 1813. This work gave the French the first intimation of the intellectual development of Germany.

Returning to Coppet from France, Madame de Staël was subjected to new persecutions, and was forbidden to go farther from her residence than two leagues. But in the spring of 1812 she escaped, and passing through Vienna to Moscow, on the approach of the French army went to Saint Petersburg, and soon after, in the autumn of 1812, to Stockholm. From Stockholm she went to England, where she was received with the most flattering attention. Here was published her 'Réflexions sur le Suicide,' and 'Zulma et trois Nouvelles.' After a long exile, described in her 'Dix Années d'Exil,' she landed at Calais in 1814. After the Restoration in 1815 she returned to Paris, and was received with great distinction. She also received from the government public stock to the amount of 2,000,000 francs, due to her father by the treasury at the time of his dismissal from office. Surrounded by a happy domestic circle, esteemed and courted by the most eminent men of the capital, she lived in Paris, with the exception of a short absence, till her death, and until her last sickness she was employed on her 'Mémoires et Considérations sur les principaux Evénements de la Révolution Française' (1819). By her will it was made known that in 1812 she had been married a second time to a M. de Rocca, a young officer of hussars, who, suffering from wounds received in Spain, had quitted the service, and come to reside at Geneva, where she became acquainted with him.

Consult 'Life' by Norris (1853); d'Haussonville, 'Le Salon de Madame Necker' (1882); Lady Blennerhasset, 'Frau von Staël' (1888–9); Brunetière, 'Evolution de la Critique' (1890); Sorel, 'Madame de Staël' (1890); Faguet, 'Politiques et Moralistes' (Vol. I., 1898).

Staff, in the army, a body of officers whose duties refer to an army or regiment as a whole, and who are not attached to particular subdivisions. The staff includes the general officers commanding divisions, district brigades, etc.,— the officers of the quartermaster-general's and the adjutant-general's departments, called the general staff; officers attached to commanding general officers as military secretaries and aides-de-camp, called the personal staff; officers employed in connection with the civil departments at the war office; and those engaged in recruiting and garrison work. See General Staff of the United States Army.

Staff, an artificial stone or cement used to cover or ornament large buildings and structures built for temporary occupation. It is made chiefly of powdered gypsum or plaster of Paris, with a little cement, glycerin, and dextrine, mixed with water until it is about as thick as molasses, when it may be cast in molds into any shape. To strengthen it coarse cloth or bagging, or fibres of hemp or jute, are put into the molds before casting. It becomes hard enough in about a half hour to be removed and fastened on the building in construction. Staff may easily be bent, sawed, bored, or nailed. Its natural color is murky white, but it may be made of any tint to resemble any kind of stone, and may be painted and gilded.

Staff was invented in France about 1876 and was used in the construction and ornamentation of the buildings of the Paris expositions of 1878 and of 1890. It was also largely used in the construction of the buildings of the Columbian Exhibition at Chicago in 1893, and at the Omaha and Buffalo expositions in 1898 and 1901. With-

Digitized by Google

out this cheap and easily worked material the great and splendid buildings would have been impossible, for they were little more than skeletons of iron and timber covered with staff.

Staff is well-nigh fireproof. Frost does not hurt it. Rain has little effect upon it. A drip injures it. As a veneer for the ordinary exposition building it lasts scarcely ten years, for the reason that these buildings have inadequate foundations. They settle and force cracks in the walls. When anchored to brick buildings or spread on expanded lath, staff will doubtless prove to be a serviceable outside finish, easily repaired and moderate in cost. Its fitness for a permanent finish is beginning to receive the attention of American builders.

Staff, in music, the five parallel lines, and their intermediate spaces on which the notes, sharps, flats, and other musical characters are placed. See MUSIC.

Staff Colleges and Schools, military institutions for the advanced instruction of officers desirous of being placed on the staff of the army. See ARMY; GENERAL SERVICE AND STAFF COLLEGE; MILITARY SCHOOLS.

Staffa, stăf'a, Scotland, a small island of the inner Hebrides, situated five miles west of Mull. It is celebrated for its basaltic pillars and natural caves, the most noted of which is Fingal's Cave. The island, which is one half mile in diameter, consists of columnar basalt capped by a shapeless mass. This gives the interior of the caves almost architectural forms. Fingal's Cave extends 227 feet inward, and the opening is an arch 66 feet high. The floor is covered with from 9 to 18 feet of water.

Stafford, stăf'ŏrd, **Henry,** duke of Buckingham. See BUCKINGHAM, DUKES OF.

Stafford, William Howard, VISCOUNT, an English statesman: b. 30 Nov. 1614; executed on Tower Hill 29 Dec. 1680. He was the son of the 20th earl of Arundel, the well-known collector of the Arundelian marbles. In November 1640 he was created Viscount Stafford. He was brought up in the Roman Catholic faith, and adhered during the civil wars to the royal cause; but after the Restoration he was frequently found in opposition to the court, although he appears never to have played an important part as a legislator. He was singled out by Titus Oates, the contriver of the «popish plot,» as one of his chief victims. On 23 Oct. 1678 Oates deposed before the House of Commons that upon the subversion of the kingdom by the Jesuits, Lord Stafford was to have the appointment of paymaster of the army; and on the 30th the accused nobleman was committed to the Tower, with other Catholic peers against whom similar charges had been preferred. After lying two years in prison, he was brought to trial on a charge of high treason 30 Nov. 1680. During a trial of seven days he defended himself by pointing out the weakness of Oates' evidence, so that Evelyn, who was present, thought «such a man's testimony should not be taken against the life of a dog.» Nevertheless a verdict of guilty was pronounced by a vote of 55 to 31. He was executed three weeks afterward.

Stafford, England, capital of Staffordshire, on the River Sow, 25 miles southeast of Crewe. The principal buildings include the Church of Saint Mary's, which has fine stained glass and many interesting monuments; Saint Chads, a fine old Norman church; a stately county hall; a borough hall, containing a museum, and the market hall; hospital, asylum, a Latin school (1550), technical schools, and a theatre. The town has extensive tanneries and manufactures leather goods, engineering and electrical works. In the neighborhood is Stafford Castle. Many ancient buildings like High House attest to the antiquity of the town.

Stafford Springs, Conn., borough in Tolland County; on the Willimantic River, and on the Central Vermont Railroad; about 48 miles north of New London and 18 miles northwest of Willimantic. It is in an agricultural and a manufacturing section of the State. The chief manufacturing establishments are woolen mills, iron works, machine shops, flour mill, creameries, and tobacco works. There are Protestant Episcopal, Roman Catholic, Congregational, and Methodist Episcopal churches. The educational institutions are a public library, founded in 1874, a high school, and public and parish schools. The national bank has a capital of $50,000; there is one savings bank. Stafford Springs is a favorite resort for health seekers on account of the mineral springs. Pop. (1890) 2,353; (1900) 2,460; (1910) 3,059.

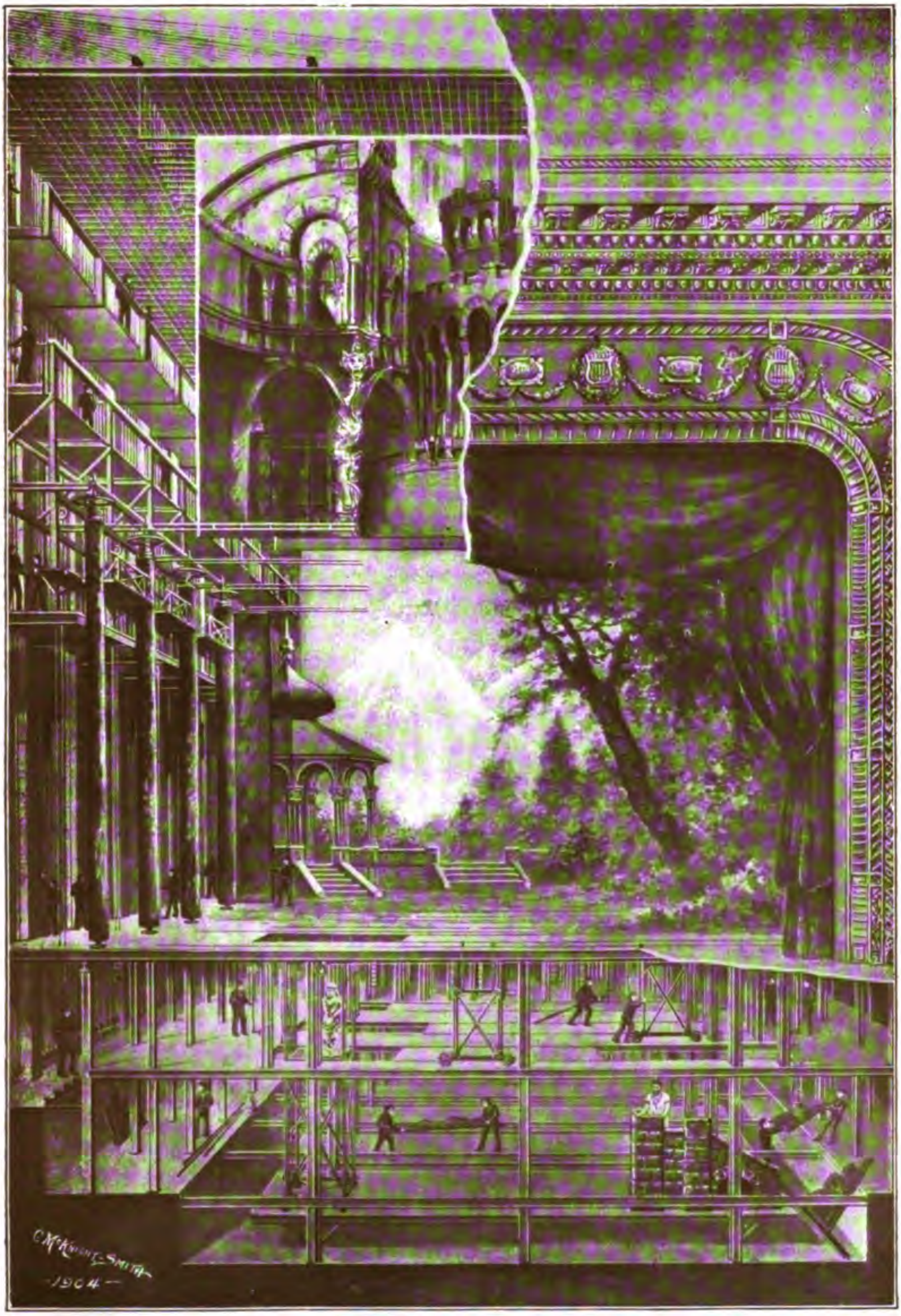
Staffordshire, stăf'ŏrd-shĭr, England, a midland county, with an area of 1,128 square miles. The Moorlands is a hilly district at the north, intersected by deep valleys. The surface is mostly undulating. The Trent is the chief river and its tributaries are the Sow, Tame, Blythe, and Dove. Few valleys are fertile in the central portion. In the south are important iron and coal deposits. The Dudley and Pottery coalfields contain several hundred collieries, and produce large quantities of ironstone. Important copper-pits are found near Warslow, while on the banks of the Dove at the north, colored marble alabaster, mill stones, and chalk, are found. The clay for pottery which makes the Wedgewood ware famous is taken from the «Potteries» district of North Staffordshire, where extensive china and pottery factories exist. The manufacture of various metals is extensive, also leather, silk, wool, linen, and sailcloth. The important towns are Stoke-upon-Trent, Burton, Wolverhampton, Wallsall, Handsworth, and Smethwick.

Stag. See DEER.

Stag-beetle, a beetle of the family *Lucanidæ*, in which the jaws of the males are greatly enlarged and studded with spike-like protuberances which give them a resemblance to stag antlers. The mandibles of the females are short, of smaller size, and curved; and the club or terminal part of the feelers is four-jointed. These beetles are vegetable feeders, and subsist upon the tender leaves and other parts of plants. The larvæ are found in trees, into the substance of which they burrow.

Stage, The American. In order to convey to the reader a fair understanding of the progress of the American theatre since 1795 it is perhaps necessary to state something about its beginnings, which, indeed, previous to 1750, are involved in much obscurity. Tony Aston, an English stroller of some celebrity, visited the

Digitized by Google



STAGE MECHANISM FOR THE OPERA PARSIFAL.

Digitized by Google

Southern and Middle colonies about 1730, and gave entertainments at New York and perhaps other places; and there is some evidence that a company of comedians acted plays in New York in 1732; but it was not until 1749 that an organization came into existence of which we can form any definite judgment. This company attempted to open a playhouse in Philadelphia, and Addison's 'Cato' was actually performed; but the performers were arrested and admonished by Recorder Allen to give up the undertaking. Thomas Kean was the principal actor in both tragedy and comedy, and one Murray seems to have been associated with him in the management. Finding Philadelphia too inhospitable, the players went to New York, where they were advertised as the company of comedians from Philadelphia, and gave the first theatrical season of which we have any connected account. The performances were given in a "convenient room" in a house belonging to Rip Van Dam in Nassau Street, and extended over a period of more than a year — from 5 March 1750 to 8 July 1751. The first play was 'Richard III.,' in which Kean played Richard. So far as is known, the company appeared in 15 plays and 9 farces. Although Mr. Kean formally announced his withdrawal from the stage to resume his business of writing, he was with a company called the "Virginia Comedians" at Annapolis in the summer of 1752, when Lewis Hallam and his London players arrived at Williamsburg, Va. Besides Mr. Kean there were other members of the New York company among these "Virginia Comedians." Perhaps this disposes of the claim usually made for Hallam's company as being the first regular theatrical organization in America.

Lewis Hallam, who brought a company of comedians from London in 1752, was not an actor of any consequence in England, nor is it likely that his wife, known to the American stage successively as Mrs. Hallam and Mrs. Douglass, was an actress of recognized ability there. William Hallam, who is reported to have furnished the money for the American venture, was not the manager of the theatre in Goodman's Fields where Garrick made his début, but of a theatre of no importance or reputation at the Wells in Lemon Street, Goodman's Fields. It was at this house that Mrs. Hallam, the wife of Lewis, played leading parts between 1746 and 1751. In the latter year she had a benefit at which she played Desdemona, with her husband, Lewis Hallam, as Roderigo. At the time of this benefit the American venture was in preparation, and one Robert Upton was sent to New York to prepare for the coming of the players. He proved false to his trust, and attempted to establish a theatre on his own account, but met with little encouragement and had disappeared before the Hallams came to Virginia.

The Hallam company reached Yorktown in June 1752, and began playing at Williamsburg on 5 September following, the opening pieces being 'The Merchant of Venice' and 'Lethe.' The only other play the Hallam company is known to have performed at Williamsburg was 'Othello,' 9 Nov. 1752. From Williamsburg Hallam went to New York, where he arrived in June 1753, just one year after the arrival at Yorktown. The New York season lasted from 17 Sept. 1753 until 18 March 1754. Mrs. Hallam played the leading parts in both tragedy and comedy, while her daughter, Miss Hallam, was put forward in farces. Hallam seldom appeared. The great Shakespeare roles were divided between Malone and Rigby, the former playing Shylock and Lear, and the latter Richard and Romeo. From New York the company went to Philadelphia, where the engagement was limited to 24 performances and one night for the benefit of the poor. The season began 15 April 1754 and closed in June. This ended the theatrical campaign of Lewis Hallam the elder, who retired with his family to Jamaica, where he died soon afterward.

A year or two after Mr. Hallam's death his widow married David Douglass, who organized a theatrical company in Jamaica in 1758 for another American campaign, with Mrs. Douglass as his chief attraction. Besides his mother, young Lewis Hallam was the only member of Mr. Douglass' company who had previously appeared in the New York and Philadelphia theatres. He had already become a full-fledged tragedian, although he was only in his 20th year, sharing the leading parts in tragedy and comedy with Mr. Harman, as Rigby had previously shared them with Malone. Mrs. Harman, who was a daughter of Charlotte Charke and a grand-daughter of Colley Cibber, was also with the company, and next in consequence to Mrs. Douglass. The low comedian was Owen Morris, who was identified with the American theatre for a full half-century — 1759–1809. After his arrival in New York, Douglass had much difficulty in obtaining permission to open the theatre that he had built on what was called Cruger's Wharf, and it was not until 28 Dec. 1758 that he began his season with the tragedy of 'Jane Shore.' The season was a very brief one, closing 7 Feb. 1759.

During the following spring and summer Mr. Douglass built a theatre at Vernon and Smith streets, in Philadelphia, which he opened 25 June 1759, and maintained with considerable regularity until the close of the year. He had obtained authority to act from Governor Denny, and the compact was kept, although the opposition to the theatre was so great in the province that an act prohibiting plays was passed by the assembly to go into effect 1 Jan. 1760. After Philadelphia was closed against him, Mr. Douglass went to Annapolis, where he played an engagement extending from 3 March to 12 May 1760. The company also performed in other Maryland towns, and then invaded Rhode Island, playing engagements at Newport and Providence in 1761. In the autumn Mr. Douglass built another theatre in New York, in what was then Chapel (now Beekman) Street, where he gave performances from 19 Nov. 1761 to 26 April 1762. This ended his first attempt to achieve the mastery of the colonial stage. In his few years of management Douglass had become an actor of considerable authority, attempting such parts as Sir John Falstaff in 'King Henry IV.,' and Mercutio in 'Romeo and Juliet.' In the latter young Hallam played the lover to his mother's Juliet. In the last New York engagement, Mrs. Hallam, the wife of the youthful tragedian, was seen in a few parts, but the pair separated soon afterward.

It has always been understood that after his retirement from New York in 1762 Mr. Douglass

Digitized by Google

did not venture upon the Continent again until 1766, when he built the Southwark Theatre in Philadelphia. On the contrary, he appeared in Charleston in November 1765, and remained there until the following April. Lewis Hallam was not with the company, and, with the exception of Mrs. Douglass and Miss Hallam, the performers were all new to the stage. Only three of the new players were still with Douglass when he reached Philadelphia — Messrs. Woolls and Wall and Miss Wainwright. With the opening of the new theatre in Southwark, Philadelphia, began the theatrical organization afterward known as the «Old American Company.» Lewis Hallam was once more in the lead. Mr. Morris and Mrs. Harman were again with the company. On the opening night Miss Cheer appeared as Katherine in 'Katherine and Petruchio,' and subsequently succeeded to most of the parts previously filled by Mrs. Douglass. Mr. Woolls and Miss Wainwright were the principal singers. During this season a so-called comic opera, 'The Disappointment,' said to have been written by Colonel Thomas Forrest, afterward a distinguished officer in the Revolutionary army, was announced for production, but it was withdrawn because it contained «local reflections.» As a recompense for its withdrawal, 'The Prince of Parthia,' by Thomas Godfrey, Jr., was produced 24 April 1767. This was the first tragedy written and played in America. The season lasted from 21 Nov. 1766, to 6 July 1767, and was followed by a supplementary season of two months, 24 September to 23 Nov. 1767. The latter was noteworthy for the first appearance in America of John Henry, who was the partner of Lewis Hallam after the Revolution in the management of the Old American Company.

While the company was playing in Philadelphia, Mr. Douglass built a new theatre in John Street, New York, which was the second of the permanent theatres in the colonies, The Southwark being the first. The first season at the John Street house lasted from 7 Dec. 1767 to 2 July 1768. The company alternated between these two theatres down to the time of the Revolution; but Mr. Douglass found the patronage of the two cities inadequate as early as 1770–1. In the latter year he made a tour to the southward as far as Williamsburg, Va., playing at Fredericksburg, Suffolk, and other towns, and building a theatre at Annapolis, where the company played an engagement in the autumn of 1771. In 1773 Douglass also built a theatre at Charleston, S. C., which was the last of the many buildings he erected for theatrical purposes between 1758 and 1774. The company played at Charleston from 22 Dec. 1773 to 19 May 1774. It was the manager's intention to reopen the New York theatre in the autumn, and Mr. Hallam embarked for England from Charleston for the purpose of engaging recruits for the company; but in October the Continental Congress passed a resolution forbidding theatrical performances, in view of the impending Revolution, and the organization was disbanded. Hallam remained in England, where he appealed to the London public at Covent Garden Theatre as Hamlet in 1775. His mother, Mrs. Douglass, died in Philadelphia at the close of 1774, and Mr. Douglass returned to Jamaica, where he became a magistrate.

It is an interesting fact, showing the theatrical activity before the Revolution, that while the American Company was acting in New York and Philadelphia in 1766–9 there was a company in the South giving performances at Annapolis and Williamsburg. This company was known as the «Virginia Comedians» in 1768, when it gave a long season at the Virginia capital; but it assumed the name of the «New American Company» when it was at Annapolis from January to June 1769. The leading spirits of the Virginia Comedians were Messrs. Verling and Bromadge, and Mrs. Osborne, who had played with Douglass at Charleston in 1765–6, and Mr. Godwin, who was with the American Company at the Southwark in Philadelphia in 1766–7. All these were with the New American Company, with the exception of Mr. Bromadge. A number of bills of the Virginia Comedians at Williamsburg in 1768 have been preserved.

The most important annals relating to the American stage that have escaped the destroying hand of time are a collection of playbills made by Thomas Llewellyn Lechmere Wall — Mr. Wall of Douglass' company. These cover 40 years of the theatrical life of the actor, and are especially valuable for the complete information they afford in regard to the Baltimore Company, organized by Wall and Lindsay in 1782. Wall was perhaps the only member of the American Company who remained behind when Douglass returned to Jamaica in 1774. He was also the only manager who undertook to produce plays before the close of the Revolution. In 1781 he was at Annapolis giving entertainments with the assistance of his wife and daughter when the French army was on the march to Yorktown. For one of his performances at that time he succeeded in securing the services of the band belonging to the regiment of Count de Chaleur. Later in the year he went to Baltimore, where he repeated his Annapolis entertainments, and in conjunction with Adam Lindsay, a tavern keeper at Fell's Point, built a theatre, of which Lindsay and Wall were the nominal managers, with Wall as the stage director. The company was formed on what was afterward known as the «commonwealth plan.» The theatre was opened 15 Jan. 1782, and continued open without important interruptions until 9 July — forty-two nights. In all 19 plays and 14 farces were produced, and the total receipts for the season were $14,209, an average of $338.50 per night. With the exception of the Walls the players were all new to the American stage, and, it may be assumed, were all amateurs.

The second season at the Baltimore theatre extended from 13 Sept. 1782 to 7 Feb. 1783; but the house was closed from 18 Oct. to 15 Nov. 1782, when the company was at Annapolis. On the third night of the season at Baltimore, Mr. and Mrs. Dennis Ryan appeared in 'Douglass,' the former as Young Norval and the latter as Lady Randolph. Ryan dominated the company from the outset, and when Wall retired from the management, 7 Feb. 1783, he assumed the reins, keeping the theatre open from 11 February to 9 June. From Baltimore Ryan carried his company to New York and opened the theatre in John Street, 19 June, keeping it open until 16 Aug. 1783; although the city was still in the occupation of the British. Wall was with Ryan's company, which remained until the evacuation, giving two performances in October 1783, while the military

Digitized by Google

players gave a performance for Mrs. Ryan's benefit. In the winter Ryan again opened the Baltimore theatre, the season extending from 7 Dec. 1783 to 14 Feb. 1784. The only noteworthy event of this season was the first production of the 'School for Scandal' in America, 3 Feb. 1784, with Mrs. Ryan as Lady Teazle. After the close of the Baltimore season in 1784, Ryan took the company to Richmond, where he played a long engagement. Mr. Heard, who was the original Sir Peter Teazle in this country, joined the forces of Hallam and Henry, while other members of the organization found professional employment in the South during the rest of the century.

After the Revolution both Lewis Hallam and John Henry sought to control the theatres that had been built by Douglass; but Hallam was the first to present a company of comedians to the New York public, opening the John Street Theatre 24 Aug. 1785. None of his players had ever appeared under Douglass' management. The Old American Company had passed into Henry's control in Jamaica, and while Hallam and his feeble forces were playing their New York engagement Henry arrived with a number of the old favorites, ready to renew operations in the United States. The company included Mrs. Henry,— previously known to theatre goers as Miss Maria Storer,— Mr. and Mrs. Morris, and Mr. Woolls. Besides these were Thomas Wignell, an excellent low comedian, afterward one of the managers of the New Theatre in Philadelphia, and Miss Tuke, who subsequently became Mrs. Hallam. Confronted by the returning players, Hallam proposed a partnership with Henry, and the firm of Hallam & Henry, which ruled the American stage during the next seven years, came into existence. The John Street Theatre reopened under their management, 21 Nov. 1785. This company played alternately in New York and Philadelphia, with an occasional visit to Baltimore and Annapolis, without any important changes in its composition until 1792, when Wignell seceded, carrying with him Mr. and Mrs. Morris. Hallam had agreed to send Wignell to England to engage recruits, but it was afterward determined that Henry should go instead. The quarrel that resulted was very bitter, but its final consequence was the establishment of the theatre in America on new foundations. Henry engaged a number of capable actors and actresses whose names are part of the history of the American stage, while Wignell not only succeeded in building in Philadelphia the first really handsome and complete theatre in the United States, but put into it the best company of players that had as yet been tempted to cross the Atlantic.

The only incident of the Hallam and Henry partnership, previous to the reorganization of the company, that needs to be noted here is the production of the first American comedy, 'The Contrast,' by Royall Tyler. This piece, which was first produced in New York 18 April 1787, was written for Wignell, who wished to play a Yankee character. Wignell's Jonathan deserves remembrance as the forerunner of the long series of stage Yankees that afterward became popular with American audiences. The comedy was printed in Philadelphia, and was often played by strolling companies before the close of the century.

The only really important recruits engaged by Mr. Henry in England were Mr. and Mrs. Hodgkinson, of the Bath and Bristol theatres, and Mrs. Wrighten, who had long been a favorite singer and actress at Drury Lane. Hodgkinson was a man of great talent and versatility, and the best actor seen in America up to that time and for many years afterward. He made his début as Don Felix in 'The Wonder,' at Philadelphia, 26 Sept. 1792, succeeded Henry as one of the managers of the Old American Company in 1794, and was active as actor and manager in New York until after the opening season at the New Theatre in 1798. Mrs. Hodgkinson, known at Bath and Bristol as Miss Brett, was an actress of merit, and in this country eclipsed both Mrs. Henry and Mrs. Hallam, the wives of the managers by whom the Hodgkinsons were engaged. Mrs. Wrighten was known in America as Mrs. Pownall. She died at Charleston in 1796, after introducing her two daughters to the stage in this country. One of them, Caroline, married Alexander Placide, who had been a rope dancer in England. She was the mother of the famous Placide family of actors. It was during this period that William Dunlap became prominent as a dramatist and adapter of plays. His first comedy, 'The Father,' was produced at the old John Street Theatre, 7 Sept. 1789. Dunlap became associated with Hallam and Hodgkinson in the management of the New York company in 1796, and he was afterward for a brief period the sole manager of the New Theatre, better known as the Park.

After leaving the Old American Company, in the beginning of 1792, Thomas Wignell associated himself with A. Reinagle, a musician who came to America in 1786, in the project of building the New Theatre in Philadelphia, afterward known as the Chestnut Street Theatre. The house was modeled after the theatre at Bath, and was completed early in 1793; but owing to the yellow-fever epidemic it was not opened by the company of players engaged by Wignell until 17 Feb. 1794. Among the actors and actresses comprising the Philadelphia company were Mr. Fennell, a young tragedian of much promise; Mr. and Mrs. Whitlock, the latter a sister of Mrs. Siddons; and Miss George, who was the wife of Sir John Oldmixon, and was known to our stage as Mrs. Oldmixon. This company remained intact without any important changes or additions for three years, playing alternately in Philadelphia and Baltimore, with an occasional visit to Annapolis; but in the autumn of 1796 Mr. Wignell brought three important recruits from England — Mrs. Merry, the famous Miss Brunton of Covent Garden Theatre, who had become the wife of Robert Merry, the Della Cruscan poet; Thomas Althorpe Cooper, then a young man of 20 but destined to be the manager of the New York theatre for many years; and William Warren, who had been a strolling player in England, and who became the successor of Wignell in the management of the Philadelphia theatre. Mrs. Merry became a widow in 1798. She soon afterward married Wignell, and after his death she became the wife of Warren, who survived her many years.

A fortnight before the formal opening of the Philadelphia theatre by Wignell's company a new theatre in Boston, scarcely inferior to the Philadelphia house, was opened by an English company engaged and brought over by Charles Pow-

Digitized by Google

ell. This theatre was in Federal Street, and was built by subscription. It was destroyed by fire in 1798. Powell's company was a feeble one, and he was compelled to relinquish the management upon the close of his second season in 1795. Powell was succeeded by Colonel John S. Tyler, a brother of Royall Tyler, the author of 'The Contrast,' who managed the house on behalf of the stockholders from January to May 1796. The season proved a failure; but the theatre was reopened in September by John Brown Williamson, an English actor, whose wife was popular in London as Miss Fontenelle; but neither he nor his wife, nor a stronger company than had as yet been seen in Boston, availed to make the season successful. One reason for this was that a new theatre, known as the Haymarket, had been built through the exertions of Charles Powell, and opened by him for the first time 26 Dec. 1796. Among Powell's English recruits for the Boston Haymarket were Mr. and Mrs. Giles L. Barrett, the parents of the famous New York comedian, George H. Barrett; Mr. and Mrs. Simpson, afterward New York favorites; and Mrs. Simpson's three daughters, the Misses Westray, of whom Juliana became Mrs. William B. Wood; Eliza, successively, Mrs. Villiers and Mrs. Twaits; and Ellen, Mrs. Darley. Powell again failed at the Haymarket, and the house passed into the control of Hodgkinson, Hallam, and Dunlap, under the personal direction of Hodgkinson. The New York company occupied it in the summer of 1797, after which it was abandoned. The Haymarket deserves to be remembered for the production of two American war plays — 'Bunker Hill,' by John Daly Burke, 20 Feb. 1797; and 'West Point Preserved,' the first of the André pieces, by William Brown, on 17 April following. Dunlap's 'André' was not produced in New York until 30 March 1798. This epoch, 1792–8, was also remarkable for theatrical activity in the South. Not only had the Baltimore company, including Mr. and Mrs. Ryan and Mr. Wall, played a long engagement at Richmond as early as 1784, but in 1790 John Bignall and Thomas Ward West were the managers of a company called the «Virginia Comedians.» This organization maintained its existence for many years, its circuit extending from Richmond and Norfolk to Charleston. Bignall, who was held by his Southern admirers to be the best actor on the continent, died in 1794. His real name was Moneypenny, and he had been a stroller in England in the same company with William Warren, of the Philadelphia theatre. After Bignall's death West became the sole manager of the company, and piloted it over the Southern circuit for a number of years. In 1795 there was a rival theatre in Charleston, conducted by Mr. Jones, who had been previously at the Boston Theatre. His principal actress was Mrs. Whitlock, who had just retired from the Philadelphia company. A Frenchman, M. Sollee, succeeded to the management of this theatre, and organized a company in Boston to play in Charleston for the season of 1795–6. Mr. and Mrs. Whitlock, Mr. and Mrs. Placide, and Mrs. Arnold — afterward Mrs. Poe and the mother of Edgar Allan Poe — were in the company.

The prosperity which had given to America three splendid theatres within five years — the Chestnut Street in Philadelphia, the Park in New York, and the Boston Theatre in Federal Street, Boston, rebuilt immediately after its destruction in 1798 — was followed by a period of depression that was severely felt over all the country. At the close of the century Wignell was in jail for debts incurred through the Philadelphia theatre, and Dunlap, who had undertaken the sole management of the New York theatre to retrieve previous losses in New York and New England, lost his entire private fortune in the venture. Mr. Barrett was induced to undertake the management of the new Boston Theatre in 1799, but he failed dismally.

In all these cities theatrical enterprises were experimental for several years, but in every case a manager was finally found in the local company who succeeded in placing the theatre on a sound business and artistic basis. Mr. Warren, after he became Wignell's successor in Philadelphia, associated with himself in the direction of the Chestnut Street Theatre a popular young member of the company, William Burke Wood. This partnership lasted until 1825. In New York the young tragedian Cooper retrieved the fortunes of the Park Theatre and made the house a paying one for a number of years. In Boston, Snelling Powell, a brother of Charles Powell, secured control after other attempts had failed, including the assumption of the management of the Boston Theatre by Charles Whitlock in 1800. John Bernard, an English actor of some repute who joined the Philadelphia company in 1797, was for a while Snelling Powell's associate in directing the Federal Street Theatre; but for many years Powell's partner was Mr. Dickenson, who was an actor of moderate ability, but a man of sound judgment and an excellent manager. These were the dominating theatres in the United States during the first quarter of the century, and their influence in giving tone and character to theatrical enterprises in the country was felt down to 1850.

The Old American Company was designed to be permanent in organization, but all the early managers, from Douglass to Wignell and Hodgkinson, aimed at controlling a circuit of playhouses modeled after the provincial circuits in England. The building of the new theatres in Philadelphia, New York, and Boston resulted in giving companies that were permanent in organization permanence of home. These were the real stock-company days, but a tendency toward the star system was manifested almost from the outset. As early as 1796 Mrs. Whitlock played what was essentially a star engagement at the Boston Theatre; it was limited to twelve nights, for which she was paid $450 and allowed a benefit. Hodgkinson played star engagements in all the leading cities between 1798 and 1805, and Cooper followed Hodgkinson's example, and was a star from youth to old age. But the first star to shine with extraordinary effulgence in the American theatrical firmament was George Frederick Cooke. He was the first English actor of great reputation who came to America to play the leading roles of tragedy and comedy with the stock companies in the principal cities. In view of this the star system, as it ruled in the American theatres for the next half century, may be said to date from his appearance here in 1810–11.

Simultaneously with Cooke's performances in the theatres of Philadelphia, New York, and Boston were the star engagements of our own «young Roscius» — John Howard Payne. Cooke

Digitized by Google

played three engagements in Philadelphia — in all 39 nights. His highest receipts for any one night were $1,475, his lowest $474. His average for his last Philadelphia engagement of twelve nights in 1811 was $807.50. Payne played to an average about the same time of $442, while Cooper's Philadelphia average was $509. Young Payne's popularity rapidly diminished, and in 1812 he performed to receipts that fell as low as $255. After Cooke the next English star to appear in America was Holman, in 1812; but he came at a time of serious depression in consequence of the war with Great Britain, and the impression that he made fell far below his expectations. Then came Incledon and Phillips as musical stars, and after them the Wallacks, Henry and James W., and finally, to close the first decade of the star system in America, 1810–20, Edmund Kean. The great English stars who came to this country during the next three decades were Junius Brutus Booth and William Charles Macready, 1820–30; Fanny Kemble and her father, Charles Kemble, and Charles Kean, 1830–40; and Tyrone Power, James R. Anderson, and Macready, again in the fulness of his fame, 1840–50. This long period had developed only two American stars of surpassing brilliancy — Edwin Forrest and Charlotte Cushman.

The century opened with about half a score of theatres in the leading American cities, only three of which, as already described, were worthy of the name or of the drama. Between 1800 and 1850 about twenty theatres were built in New York, none of them superior to the Park, and only one, the Bowery, in any sense its rival, until Burton established himself in Chambers Street in the last decade of the epoch. The only new theatres of importance in Philadelphia during the same period were the Walnut Street and the Arch Street theatres, the former erected for a circus in 1808 and fitted up for theatrical uses in 1820, and the latter built in 1826. The theatres built in Boston in these 50 years were the Tremont, the American Amphitheatre,— afterward the Warren and National,— Kimball's Museum, the Eagle, and the Howard Athenæum. Baltimore had nothing better than the old Holliday Street Theatre during this epoch, and Washington was without a place of amusement worthy of the drama until 1835. The theatre builder of the period in the South and Southwest was James H. Caldwell. He built the American Theatre in New Orleans in 1823, and afterward erected the Camp Street and Charles Street theatres. Mr. Caldwell also built theatres in Cincinnati, Saint Louis, Natchez, Huntsville, Nashville, and Petersburg. Another manager, John S. Potter, was concerned in building as many, or more, theatres in the South and Southwest; but, after all, the theatrical activity of a century resulted in an approximate number of theatres in actual use at its close not exceeding 50.

The figures that show the periods of prosperity and the intervening periods of depression are not easily obtainable, those that are in existence being widely scattered through books and newspapers or in private hands. The losses were sometimes heavy even in the early enterprises. The Philadelphia company in 1797 played 14 weeks in New York with a loss of $2,350; but, on the other hand, Caldwell, in 1818, cleared $10,000 in four months in Petersburg, Va. The receipts of the Park Theatre, New York, for the season of 1832–3 reached nearly $150,000, Fanny Kemble and her father drawing $56,000 for 60 nights, an average of $933 per night. In 1833–4, when the receipts at the Park fell to $135,000 for the season, the Kembles averaged $732 per night; but in 1834–5, without the Kembles, the season's total was over $160,000. At this time the star system was at its height of favor, with both managers and the public; but its effects were disastrous in cities where there were rival theatres outbidding one another for the best stars. This was especially true of the managers of the three rival theatres in Philadelphia, who for nearly 20 years continued to cut one another's throats for the benefit of stars of no great magnitude. Wood, in his 'Recollections,' cites an example of the effects of the system. One of Fanny Ellsler's engagements in Philadelphia yielded $10,869.25, out of which the *danseuse* received $6,436. The money paid to the other dancers, the ballet, and for the ordinary expenses of the house brought the expenditures up to $11,826, involving a loss to the manager of $1,000 for ten nights. This system finally culminated about 1846, when nearly all the theatres in the country were ruined. But it was divided patronage as well as the excessive percentages of the stars that made the theatres in Philadelphia, New York, and Boston unprofitable; for in the South, where Caldwell had a monopoly in his own field from Richmond to New Orleans, the profits were very large, notwithstanding the frequent engagement of stars like Cooper, Booth, and Forrest. This contrast receives additional emphasis from the fact that Caldwell was the only manager produced by the first century of the American theatre who died rich.

The century that will close with this decade has witnessed a partial revival of the old stock companies in their purity and simplicity, without the intervention of great stars, and it has also witnessed the nearly complete abolition of this form of theatrical organization. In the theatres managed by William Wheatley, John S. Clarke, and, for a time, by Mrs. John Drew in Philadelphia, by James H. Wallack in New York, and by Moses Kimball in Boston, stock companies were maintained. Later on, Lester Wallack, Augustin Daly, M. H. Mallory, Daniel Frohman, Charles Frohman, and A. M. Palmer in New York, and R. M. Field in Boston, kept together for years organizations which were managed upon the pure stock system. Only one or two of these companies remain. Throughout the country generally the theatres for a while employed stock companies, but mainly for the purpose of supporting traveling stars. This continued until after the close of the Civil War, when the impetus given to business enterprises of all kinds was felt in renewed theatrical activity not only in the cities, but all over the country. What is known as the combination system (that is, a traveling company made up of a star and a supporting company), which began about 1869 and reached its highest development before 1876, involving the destruction of the stock companies in all except a few theatres, was the consequence of this theatrical revival. Nearly every inland town and city from Maine to California built a theatre, with the expectation that traveling companies would occupy it at intervals. The demand thus created could be supplied only by the combinations.

Digitized by Google

One of the first results of this new state of things was the banishment from the managerial office of all, or nearly all, the actor-managers. Their places were filled by business men, who, while they may have lowered, in a sense, the artistic character of the theatre, have raised its financial standing to a point which, during the first century of its existence, seemed beyond its reach. The theatre in America is no longer a haphazard thing, living from day to day on uncertainty. It is a business conducted on the principles which govern other forms of commercial enterprise, and is as stable, as sound, and as certain of adequate rewards as any. Indeed, so abnormal has been the development of the business character of the theatre that it has excluded from general managerial attainments everything else. Very few of the managers throughout the country ever undertake the original production of plays, or take the trouble to acquire the artistic knowledge requisite for this kind of work. New York chiefly, and in a lesser degree Chicago and Boston, are the play-producing centres. A few New York managers and the play-producing stars select and bring forth all the plays and gather together all the companies which, supplemented by the imported attractions, keep the theatres of the country supplied with entertainment during the season. The advantage of this system is that playgoers everywhere are furnished with well-trained and perfectly equipped companies, appearing in plays which have been tried and found to be worthy. The local manager, free from the worries and cares incident to stage-work, devotes his time and attention to the comfort of his patrons at the front of the house, and to the strict conduct of business there. The results are well-regulated and comfortable auditoriums and good order in all the business departments of the theatre.

A remarkable aspect of the American theatre, from a commercial point of view, is the enormous profit it has yielded and continues to yield to home and foreign celebrities. Among American actors, Edwin Forrest acquired and left behind him a great estate, from the remnant of which was established the Forrest Home, near Philadelphia, a retreat for aged actors, noble in its purpose and efficient in its benefaction; Charlotte Cushman, resting for long periods in England and Italy, left a fortune of $600,000; Edwin Booth, having made and lost more than one competency, renewed his financial successes in his declining years, and left $750,000 to his heirs, after having founded the Players' Club at a cost of $200,000; Mary Anderson retired from the stage after a few seasons of brilliant and uninterrupted triumph, to enjoy a happy marriage in her youth, her labors having brought her a fortune of $500,000; Joseph Jefferson, blessed with that continuous vitality often found among the children of the stage, had in 1902 acquired a fortune of $1,000,000. Among foreign actors, William C. Macready owed to America the realization of his dream of retirement from a profession he affected to loathe; Sarah Bernhardt acquired here a fortune which enabled her to defy the authority of the house of Molière and to establish a theatre of her own in beautiful Paris; Tommaso Salvini, adding his great earnings here to his modest ones in other lands, became the richest actor Italy has ever known; and Henry Irving has found in his frequent visits to our country a public eager and willing to fill his coffers to overflowing with the rewards so justly due to his unequaled managerial achievements and to his undoubted genius as an actor. The list of the well-rewarded favorites of the public might be greatly extended, but this glimpse of results is sufficient to make clear the profits and prosperity of the American stage, and to indicate the extent of its commercial advancement during the century.

The development of the theatre in all its departments, especially since 1860, has been vast. From not more than 100 in 1800, and fewer than 800 in 1860, the number of actors and actresses in the United States increased so immensely that in 1888 it was estimated at 4,500, and now probably exceeds 10,000. This number represents only the performers engaged in presenting the drama in its higher forms. It does not include the managers, who number several hundred, as compared with 25 or 30 in 1850 and 6 or 8 in 1800. If the exponents of variety and vaudeville and the other employees in the amusement business are added, the number of people who gain a livelihood by giving public entertainments will not fall below 30,000; including stage hands and all the persons who derive their support from the theatre, the number may be roughly estimated at 100,000. This vast army of workers is well organized, generally well paid, and reasonably prosperous. It has numerous charitable and social organizations, which are models of their kind. The Actors' Fund, the Actors' Order of Friendship, the Players' Club, the Green Room Club, the Lambs' Club, the Professional Women's League, are institutions of which any profession might well be proud; and there are numberless others of equal merit supported by the amusement makers of the United States. There are as many as 800 regularly organized theatrical companies on tour through the United States during the season, and the number of theatres of all kinds is not fewer than 6000. The cities of New York and Brooklyn have at the present moment first-class theatres in greater number than either Paris or London.

The improvement which has taken place in the construction of theatres in America within the past 20 years is worthy of especial notice. The tragic disaster in Brooklyn on the night of 5 Dec. 1876 awakened the attention of managers and of the public authorities in the different States to the flimsiness of construction which marked even the best theatres of the period. The result was the passage of new and most stringent laws, involving requirements which, while they seemed onerous, perhaps, have resulted in giving to America the best and safest theatres in the world. Even the older theatres, built before the new regulations, have been so altered under the direction of the authorities that they are now comparatively free from danger. In New York, where these regulations are perhaps the strictest, there is a larger number of absolutely safe theatres than in any city in the world: while for beauty and convenience combined with safety it is impossible to find elsewhere such theatres as the Victoria, New York, Wallack's, Knickerbocker, the Empire, the American, and the Metropolitan Opera House. As the older houses pass away they must be replaced by absolutely fireproof structures if replaced at all.

Digitized by Google

Perhaps the most marked change that has taken place in the American theatre during the century, however, is in the character and number of its patrons. Attendance upon the theatre was looked upon even 50 years ago by at least seven tenths of the people of the United States as almost a sin. The fashionable ungodly and the lowest and most depraved made up the audiences. We have seen how, in the Revolutionary period, theatres were closed by act of Congress, doubtless because, in those days of danger, the fathers of our country felt that they would help their cause by propitiating the Almighty, who was supposed to frown upon godless amusements. But in the last two decades this unreasonable prejudice against the most enjoyable and least harmful of all forms of amusement has so materially lessened that it is estimated by a good authority that not more than three tenths of the people refuse to patronize the theatres as a matter of principle. It is true that a clergyman now and then inveighs against the stage in the old-fashioned, puritanical way; but his words, in all likelihood, fall upon ears that the night before were listening to the sorrows of 'Camille' or were taking in the laughter-provoking catch-lines of 'The Private Secretary.' Indeed, the element of moral usefulness in the theatre is no longer successfully derided. In 1878 there was established in the city of New York a theatre the avowed purpose of which was to produce plays of a moral tendency, and to which religious persons might go. This effort succeeded. The theatre was thronged for several years by a new class of theatre-goers. I do not hesitate to give it as my opinion that one of the most powerful agencies in breaking down the barriers which intolerance had raised between the better people in our community and the theatre was this effort, so honorably put forth and so brilliantly carried out by the gentlemen who established the Madison Square Theatre. Their influence was far-reaching. Their plays were given in almost every city and town and hamlet of the United States, and everywhere they had the same attractiveness; and thus they increased to an extent which can hardly be estimated the volume of theatrical patronage.

It is almost impossible to forecast the future of the American stage; but we may hope, I think, that as the past century has witnessed such a marked increase in its material prosperity, the next century will be marked by a distinct progress toward higher forms of art, toward a clearer appreciation of its mission by its patrons, and toward the creation of a national drama. Considering the brief history of the stage in the United States, and the vast future of this people, what the managers and the literary artisans are now doing is but the beginning, holding the promise of great achievements; the material greatness of our stage, already greater than that of any other country, must eventually find a corresponding elevation in its literature, upon which its prosperity will so largely depend. See Drama.

Stage-coach. See Coach; Omnibus.

Stage Mechanics. A stage is that visible part of a platform arranged at one end of an auditorium which is enclosed by scenery and framed within and viewed through an opening or arch. The stage and all that may be arranged upon it must be preservative of the lines of sight and hearing of the spectator and auditor.

From earliest times either an elevation or platform, or a depression or pit have been usual for representation or entertainment before spectators. The earliest choral dances in the circle or pit evolved into the Greek classic theatre, with its skene or house of two or three stories, which filled the background of the scene, the action being within the semicircular chorus place or pit in front.

The mechanism of the ancient theatre was very exact in every respect. The religious character of the performance established fixed and usually theologic meanings for everything done or said in the play. The scenery was probably limited to painted curtains at the back and revolving triangular prisms at entrances. Machinery for startling effects was, however, usual. The Roman invasion resulted in the extension of the stage more and more forward, until it became a platform sufficiently large to hold the chorus and entire ensemble.

The ancient Greeks bore the same relation in art and theatricals to the world of their time as the modern French do to-day; consequently even the traveling companies of the various nations followed crudely the methods of performances usual with the Greeks, and, indeed, the general conduct and character of the modern theatre has in many important respects followed the original classic traditions. The entrances and exits on the modern stage, much of the symbolic values of parts of the stage, and the arrangement of stage movement are directly inherited from the old Greek theatre. In later mediæval times a portable stage or cart was used. But little advance can be noted in stage mechanism until after the time of Shakespeare and of Molière, when modern inventions began to appear. Richard Wagner and the Germans revolutionized stage settings and theatrical architecture, as notable in Wagner's Theatre in Baireuth and the Burg Theatre in Vienna. The Germans' leadership in applying science to and otherwise improving stage mechanics has been followed by every European nation, notably in England, by Sir Henry Irving, whose system of lighting is especially remarkable in the conveyance of the feeling of atmosphere to the senses of the spectators. In America Steele Mackaye was progressive in improving the mechanism of the stage.

While the use of gas and movement of scenery in grooves had been universal during the past century until 1875, yet in many theatres to-day such modes of lighting and scene shifting are still retained. In the theatres of to-day, where electricity and the most modern machinery are employed, the following are the terms and uses of the stage machinery:

THE STAGE.

Rake, The.— The scale or rise of the stage floor, from the curtain line to the back wall. A modern stage is generally built level, or nearly so. The "Rake" of the scenery is the perspective line; a gradual decrease in the height of each piece of the sides of a scene representing an interior or room and extending up stage.

Proscenium Arch, The.— The architectural arch and sides behind which descends the curtain,— as it were a massive frame to the picture which the curtain-rise reveals.

Curtain Line, The.— That line from one proscenium side to the other, across stage, where the curtain touches the ground.

Digitized by Google

STAGE MECHANICS

Apron, The.— That space of the stage from the curtain line down to the footlights. A distance usually of four or five feet. The apron in modern theatres is often almost eliminated.

Tormentor, The.— The foremost piece of scenery standing slightly out, both sides of the stage, back of the proscenium sides. It is usually red and intended as the matting to the picture framed.

Front Drapery, The.— A short curtain stretching across the proscenium arch, intended to blend with the tormentors at the required height from the ground, once the curtain has risen: thus forming an arch matting to the picture.

Prompt Side, The.— That side of the stage where the signals for rise and fall of the curtain, etc., are placed and where the prompter usually stands.

Fly Galleries, The.— Galleries that are built along the side walls of the stage. The height of these galleries above the stage varies according to the proportions of the stage and building. On an average they are erected some thirty feet from the ground. One of these side galleries is occupied — ordinarily the left side gallery — by the fly-men: a crew of men employed there to operate the ropes (called lines) whereby the divers pieces of scenery are either raised or lowered into position.

Painter's Gallery, The.— A long narrow bridge extending from one fly gallery to the other alongside the back wall of the stage. It is always movable and can be hoisted or lowered down any distance by means of ropes, and is for the purpose of touching up scenery which may necessitate fresh daubs of paint. The scenery to be painted is hung or set flat against the back wall of the stage, and the painter's bridge is then raised or lowered in front of it, according to necessity.

Rigging Loft, The.— A timber flooring some few feet beneath the roof above the stage: a network of small beams for the purpose of attaching pulleys thereto — whereby pieces of scenery, borders, etc., may be raised from the ground or lowered. The rigging loft is ordinarily built fifty feet above the stage, sometimes even higher; this to afford more room for the hoisting and retention of stacks of scenery above the setting. The pulleys are attached to the rigging loft in rows of threes, from the front of the stage to the back of the stage. In each row one pulley occupies the centre of the rigging loft; the two others occupy the left and the right of the central pulley and are stationed half way between the central one and the edge of the rigging loft. To each of these numerous rows of pulleys are affixed long ropes, one end of which is carried down by a small weight, while the other end is securely fastened in the fly galleries, usually the left gallery.

Pins, Counterweights, Sand-bags.— The "Pin" is a bar of cast iron, 15 inches long by 1½ inches in diameter. Pins, sand-bags and counterweights are attached to the loose end of the rope which drops toward the stage from the rigging loft. These weights are usually removed when a piece of scenery is fastened to the rope in their place.

Lines.— The ropes that are thus held in the rigging loft and manipulated from the fly gallery.

Centre Line, The.— The rope attached to the pulley stationed in the centre of the rigging loft, and dropping toward the centre of the stage.

Long Line, The.— The rope attached to that pulley which is farthest from the side from where it is being manipulated in the fly gallery.

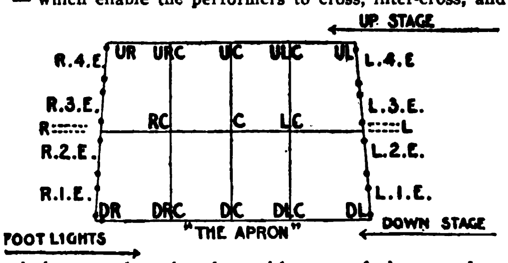
Short Line, The.— That rope which is nearest the side from which it is manipulated in the fly gallery.

Set of Lines, One.— The short, centre, and long line of one row of pulleys. The sets of lines are usually fastened together on the pegs in the fly gallery.

Traps.— A concealed opening in the floor of the stage.

STAGE POSITIONS.

The stage is divided into imaginary lines and spaces — which enable the performers to cross, inter-cross, and



circle around each other without confusion — and as well the stage carpenter to erect his scene, and the stage-hands to set their furniture in the proper places.

It is assumed that there are four entrances. These are counted 1, 2, 3, 4, from down stage up.

N. B.— Though there may be but one entrance on one side of the interior setting — direction may possibly be given to set a fireplace or window R.2. (right second); that is to say, where right second entrance should have been had it existed.

EXPLANATION OF THE ABBREVIATIONS.

R. 1. E.— Right first entrance.
R. 2. E.— Right second entrance.
R. 3. E.— Right third entrance.
R. 4. E.— Right fourth entrance.
L. 1. E.— Left first entrance.
L. 2. E.— Left second entrance.
L. 3. E.— Left third entrance.
L. 4. E.— Left fourth entrance.
C.— Centre of stage.
D. C.— Down centre line.
U. C.— Up centre line.
U. R. C.— Up right centre line.
R. C.—Right centre line.
D. R. C.— Down right centre line.
U. L. C.— Up left centre line.
L. C.— Left centre line.
D. L. C.— Down left centre line.
D. R.— Down right of stage.
D. L.— Down left of stage.
L.— That side of the stage which is left of a person facing the audience.
R.— That side of the stage which is right of a person facing the audience.
U. R.— Up right of stage.
U. L.— Up left of stage.

THE SCENERY.

Wing, A.— A single piece of scenery, ordinarily 5 feet 4 inches wide by 18 feet high.

Flat, A.— A double wing, either hinged or battened together.

Borders.— Strips of canvas hung crosswise above the stage by means of a set of lines. These may either represent the sky, the branches of trees and foliage, etc.

Ceiling.— A square of canvas set to a light frame of wood which is lowered by means of a double set of lines — one set "up stage" (back of stage), the other "down" (front of stage), until it rests squarely upon the interior set.

Box Set, A.— A complete interior setting.

Drop, A.— A large canvas representing the background of the setting. In the case of a complete exterior setting, the drop extends the full width of the back of the stage; in the case of an interior setting, where, for example, only a window and a door present a view of the outside, the drop may be much narrower.

Tab, A.— A narrow drop, hung by a single line.

Jog, A.— A narrow piece of scenery, wherewith two flats or wings of an interior setting may be joined, either for extension or to form a quadrangle.

Return Pieces.— Two wings affixed to an interior setting, which turn off stage, back of each side of the proscenium opening.

Backings.— Either a wing, or two wings hinged together, set back of some opening, window, or door.

Masking Pieces.— A piece of scenery, tab, drop, or wing, set behind an opening to conceal either the scenery or the bare stage immediately behind it.

Braces.— Two narrow strips of wood, five feet long, either permitted to slip alongside each other or made fast to each other by means of a turn-screw once the desired extension is reached. The top end has a small iron grip attached, in the shape of a ram's horns; the lower has a narrow short blade of steel intended to trail flat upon the ground and containing a hole sufficiently large to admit a screw-pin. The grip at the top of the brace is first introduced into a screw-eye attached to the back of a piece of scenery, then the desired length of the brace is secured by means of the centre screw, so that it reaches the ground obliquely; lastly, then, the screw-pin fastens the brace securely to the ground: and thus may scenery be held in position.

Lashlines.— Pieces of light rope fastened at the side of the wooden frame near the top of a wing or flat, for the purpose of fastening this wing or flat to the next one.

THE LIGHTS.

Footlights (of the stage.)— Rows of lights along the front edge of the stage.

Border Lights.— The illumination of a series of electric bulbs in a long tin reflector, extending the full width of the stage and hung up in the air, by means of a set of lines, back of the canvas borders. There are usually four border lights, more or less, according to the depth of the stage and the style of the play:

Digitized by Google

No. 1 border light is hung close to the curtain down stage; No. 4 is hung well back of stage; the other two, Nos. 2 and 3, occupy the intersecting positions.

Strips.— Several electric bulbs set to a narrow strip of wood, varying in length according to necessity — usually four feet long, which may be movable and hung anywhere back of the setting.

Bunch Light.— Several electric bulbs inside of circular and movable tin-reflector.

Box Calcium.— An oval, sheet-iron box with an open front 18 inches by 14 inches, set upon a long steel rod incased in a tubing — for the purpose of raising or lowering. The box is painted white within and contains carbon holders and carbon sticks — and is for the purpose of throwing a wide flood of white or colored light.

Mediums.— A light frame of wood, the size of the opening of the box calcium. The space within this frame is filled with a thin sheet of gelatine: the gelatine being colored either red, blue, green, amber, etc. Thus sunset glow, moonlight, sunlight effects may be secured by the use of a different medium.

Lenses.— A sheet-iron hood, set to a steel rod and operated in the same way as the box calcium, but, for the purpose of throwing a shaft of light: that is, a moonbeam, a sunbeam.

Pockets.— Concealed, safety, steel pockets in the floor of the stage, on both sides, for the purpose of connecting wires, leading to calciums, bunch lights, etc. Usually there are three pockets on each side of the stage.

The Switch-board.— The electric board — usually on the prompt side — where all connections are made for the electricians to operate all the lights from a single place.

J. M. Edgar Hart,
Instructor of the American Academy of Dramatic Arts.

Stagger-bush, an ericaceous shrub (*Pieris*, or *Andromeda mariana*) found south of Rhode Island in moist sandy soil, chiefly along the Atlantic coast. It has a bad reputation for poisoning live-stock which may feed on its foliage, and giving them the disease known as "staggers." It is a low shrub, rarely four feet high, with erect, wand-shaped, black-dotted branches, bearing alternate, oval leaves, which are shining and leathery, and turn to an intense scarlet before falling in the autumn. The flowers are borne in axillary umbels, on the under side of the naked year-old branches, and are large, white, waxen urns, with five little teeth about the orifice. They bloom in early summer, and the shrub is one of the handsomest of its kind.

Staggers, one of several varieties of disease in domestic animals, as blind-staggers in horses and cattle, an epileptic disorder primarily affecting the brain and spinal cord. A form of digestive derangement to which horses are especially liable is a kind of gastritis called stomach-staggers. This is a dangerous disease as yet little understood. In the stable the horse dozes and rests his head in the manger; he then wakes up and eats until the distention of the stomach becomes enormous. The peculiarity of the complaint consists in the total stoppage of digestion, and the uneasy feeling of distention, consequent to such indigestion, appears to deceive the horse, whose morbid excitement induces him to continue eating. This he does until the distention prevents the return of the blood from the head, and the animal dies from apoplexy, or his stomach bursts. Recovery is rare, except in very mild cases. Grass-staggers is a disorder caused in horses and cattle by eating the loco-weed or crazy-weed (q.v.). It is also known as the loco-disease. In sheep a peculiar kind of staggers occurs which is called gid. See Sheep, Diseases of.

Staghound. See Dog.

Stahl, stäl, **Georg Ernst,** German physician and chemist: b. Anspach 1660; d. Berlin 1734. He studied medicine at Jena and in 1691 was chosen second professor of medicine at Halle, and rendered his name famous over all Germany by his academical prelections and his publications. In 1700 he was elected member of the Academia Curiosorum Naturæ. His fame procured him the appointment of physician to the king of Prussia in 1716, and he went to Berlin. He was the author of the doctrine which explains the principal chemical phenomena by the agency of phlogiston. This theory was received and supported by some of the most eminent men which Europe had produced. His principal works are 'Experimenta et Observationes Chymicæ et Physicæ' (1731); 'Disputationes Medicæ'; 'Theoria Medica Vera' (1737); and 'Fundamenta Chymiæ Dogmaticæ et Experimentalis.'

Stahr, stär, **John Summers,** American college president: b. Bucks County, Pa., 2 Dec. 1841. He was graduated from Franklin and Marshall College 1867, and at once entered the faculty of that institution, successively being tutor in German and history, assistant professor, professor of natural science and chemistry, financial agent, president pro tem, and since 1890 president of the college. He studied theology, was ordained in 1872, and at one time supplied the pulpit of the First Reformed Church, Reading, Pa. He was a consulting member of the editorial staff of the 'Standard Dictionary.'

Staigg, stāg, **Richard M.,** American painter: b. Leeds, England, 1820; d. 1881. He emigrated to the United States in his 11th year and in early manhood attained consummate skill in painting miniature portraits on ivory. In 1861 he was elected National Academician, and after studying in Paris (1867–9) he abandoned miniature painting for landscape and portraiture in oils. His marines are admirable for color and detail and among his best genres are the 'Sailor's Grave' (Lenox Library), and the 'Cat's Cradle.

Stained Glass. See Glass Staining.

Stainer, stī'nĕr, **Jakob,** German violin-maker: b. Absam 14 July 1621; d. 1683. He was apprenticed to a maker of stringed musical instruments at Innsbruck. He learned the secret of the Italian method of constructing violins, and won a reputation that passed beyond Germany into Italy and England and lasted for more than a century.

Stainer, stā'nėr, **Sir John,** English organist and composer: b. London 6 June 1840; d. Verona, Italy, 1 April 1901. At seven he became a chorister in Saint Paul's Cathedral; in 1856 Sir Frederick Ouseley appointed him organist of the newly-founded Saint Michael's College at Tenbury, and four years later he became organist of Magdalen College, Oxford. From 1863 till 1872 he was university organist, and from the latter year until his resignation in 1888 held the post of organist in Saint Paul's, London. In this position he achieved great success, and contributed much to the improvement of the musical part of the service in the cathedral. In 1881 he succeeded Sir Arthur Sullivan in the principalship of the National Training School, and in 1882 became inspector of music in the elementary schools of

Digitized by Google

England. He was professor of music in the University of Oxford from 1889 till his resignation in 1899, and was knighted in 1888. He was a composer of considerable ability, his principal compositions being cantatas entitled 'The Daughter of Jairus' (1878); 'Saint Mary Magdalen' (1883); and 'The Crucifixion' (1887), and many anthems, organ pieces, etc. He published various musical primers, a 'Dictionary of Musical Terms' (with W. A. Barrett), and a valuable work on 15th century music entitled 'Early Bodleian Music: Dufay and his Contemporaries.'

Staines, stānz, England, a town in Middlesex, on the Thames, six miles southeast of Windsor. Runnimede, Egham, and Cooper's Hill are interesting suburbs (q.v.). Inigo Jones and Rennie, two of England's greatest architects, are remembered by the church of St. Mary's (1631), and the bridge across the river (1832), respectively their works. The Roman Catholic Gothic church dates from 1868. The industrial works include breweries and mustard mills. The garden-markets and race-course are interesting features.

Stair, Lord. See DALRYMPLE.

Stair, a succession of steps affording means for a person on foot to get from a lower to a higher level. There are two main forms of this, one composed of a series of solid blocks generally touching one another at one edge, as when a series of squared stones are built into a wall at either end, their small surface of junction merely steadying them; and the more common sort, in which two sloping beams, planks or metal girders called string pieces or strings, support a series of horizontal planks, slabs of marble or slate, or plates of metal; these are called treads. The above are the essentials of a stair. The riser which stands for the vertical distance from one tread to another may be left open, or may be filled by a light board, a piece of open-work cast iron or the like. In the case of a stone step the tread is the uppermost surface and the riser the front — the surface turned toward the person who is ascending.

There is a marked distinction between the straight and the winding stair. In a straight stair all the steps are called fliers and the tread of each is of the same width from end to end. In the winding stair the steps are called winders and the treads are much narrower at one end than at the other. The typical winding stair is the spiral or corkscrew stair (in French called *à colimaçon*, snail-like). These are commonly built into round towers, the walls of which support the steps, but it is feasible to build them of wood or iron, and in modern libraries and other places of storage, very light spiral stairs are built for easy access to balconies, galleries, and upper floors, as in the stack-room for books or other place of deposit or storage.

A stair may be made up of several short stairs called usually flights. Thus in the case of a rather lofty story, there may be one or even two landings in the height from floor to floor, and therefore two or even three flights. If these landings give to the stair a change of direction of 90°, so that a person ascending and going northward suddenly turns eastward or westward, the platform is called a quarter-pace (sometimes quarter-space). If the change of direction is of 180°, the person ascending reversing his direction as from north to south, the word half-pace (half-space) is used. A combination of these methods is also used, as where a platform is associated with some winders; the platform being then nothing but a tread much wider than the others. This is a very objectionable plan, as being dangerous for persons not acquainted with the stair.

The height of the riser and the width of the tread are matters of great importance. Rules exist for fixing these, and it is generally considered that the riser and tread must be taken together. Thus, if it be held that each tread-and-riser should measure 18 inches, then the riser may be 6½ inches high, the tread 11½ inches wide. This is often expressed by the formula, a rise of 6½ inches, a run of 11½ inches, or by the phrase, the rise and run are to each other as 6½ to 11½. In modern buildings of no great cost or elegance the stairs are often very much steeper than this; and the proportions may even be reversed, or nearly so, in the case of a flight rarely used, as from the top floor to the roof.

The stair is often an architectural feature of some importance. In the interior a large hall is sometimes devoted to it, and the stair itself is a principal part of the decoration, perhaps passing along three sides of this hall, seeming to cling to the wall as it ascends, leaving below an open floor of considerable size which may be treated more or less as a sitting-room, and at the top communicating with a gallery. This gallery may be a highly architectural member, being treated with columns to support the roof. The objections to this treatment of a stair are the great amount of space occupied, and the opening of so much of the interior to drafts of air and to ready communication of fire. It should only be used where the building is wholly fireproof. It leads to great expense in building the stair of marble, lining the walls with the same or an equally costly material, and roofing the whole with an architectural dome or coved ceiling with or without a sky-light. The tendency in recent times is to use elevators in buildings of all kinds, public and private, and in consequence of this the stair seems to be considered sometimes a mere piece of utility, and for that purpose made as compact as possible; while in another building not more costly and splendid it will be treated in the way described above. It is worthy of notice that any building in which it is expected to give stately entertainments, the stair-case, or hall, which encloses the stair, will be treated in a more stately way, and this because of a tradition that the persons of a large assemblage will seek the halls and stairs, perhaps for more space, perhaps for fresh air. Thus, in an opera house built with cost and pains, the stair is a very important feature.

Out-of-door stairs are not common in modern times, nor do they often exist in connection with classical or neo-classical architecture. They have great picturesqueness of effect and are associated with mediæval architecture — both northern and southern — and with the rough wooden buildings of Switzerland and Tyrol.

The term stair is not often used to cover the broad flight of steps leading up to a portico;

Digitized by Google

nor for the steps of a front door when they do not exceed ten or twelve in number; nor yet for those in a terraced garden. For such out-of-door flights of steps the French term *perron* may be used and is perfectly descriptive of the thing; no correlative term exists in English except the local term used in New York city and vicinity, stoop. RUSSELL STURGIS.

Stalac'tite and **Stalag'mite,** deposits of lime hanging from the roof (stalactites) or rising from the floor (stalagmites) of a cavern. Stalactitic formations occur chiefly in long and more or less fantastic masses suspended from the roofs of caverns in limestone rocks. Stalactites appear to be continually forming; water containing carbonate of lime held in solution by carbonic acid, trickling through crevices in the roofs of the caverns, gradually during its exposure to the air loses its carbonic acid, and consequently deposits its carbonate of lime; the water passing over the portion first deposited gradually adds to it, and eventually gives the carbonate of lime its great length and stalactitic character. The flatter deposits, called stalagmites, are formed on the floor of the cavern by the water there depositing that portion of its carbonate of lime which is not separated during the formation of the stalactite. Stalactitic carbonate of lime is met with in the veins of lead ore in Durham and Northumberland, England. Caverns are sometimes nearly filled with these deposits, which in some cases are of very large dimensions. The Oriental alabaster (q.v.) is of the same substance as stalactites and stalagmites. Among the striking examples of these formations are those of the Luray and Mammoth caves (qq.v.) in the United States; those in the cavern at Castleton, Derbyshire, England, and in the Isle of Skye; in the grotto of Antiparos in the Grecian Archipelago; in the Woodman's Cave in the Harz, Germany; at Auxelle, France; and the most important of those at Adelsberg, Austria-Hungary.

Stalimene, stä-lē-mā'nē. See LEMNOS.

Stalker, stâk'ėr, **James,** Scottish Free Church clergyman: b. Crieff 21 Feb. 1848. He was educated at the universities of Edinburgh, Halle and Berlin, and at New College, Edinburgh. He held pastorates at Kirkcaldy and Glasgow, 1874–87; delivered the Lyman Beecher lectures on preaching at Yale University, 1891; was Cunningham lecturer in 1899, and has been professor of church history in the United Free Church College, Aberdeen, since 1902. Among his many publications are 'The Life of Jesus Christ,' 'The Preacher and His Models,' 'The Seven Deadly Sins,' 'The Seven Cardinal Virtues,' 'The Two Saint Johns,' 'The Christology of Jesus,' etc.

Stall, Sylvanus, American Lutheran clergyman and author: b. Elizaville, Columbus County, N. Y., 18 Oct. 1847. He was graduated from Pennsylvania College, Gettysburg, 1872, and studied theology there and at the Union Theological Seminary in New York. He held Lutheran pastorates from 1874 to 1888, and has been associate editor of the 'Lutheran Observer' since 1890. He was for years statistical secretary of the general synod of the Lutheran Church and published 'Stall's Lutheran Year Book and Historical Quarterly,' 1884–8. His other publications include 'How to Pay Church Debts' (1880); 'What a Young Boy Ought to Know' (1897); and the three other volumes of the 'Purity Series,' concluding with 'What a Man of Forty-five Ought to Know' (1901).

Stall, a fixed seat in a church, intended for the accommodation of one of the choristers or of the clergy, and therefore usually in the choir. Much the most common arrangement is to have the stalls in rows on the two sides of the choir, the occupants of the stalls looking inward toward the axis of the church and therefore toward the altar or the space immediately behind or before it. Such a fixed seat forming one of a group will naturally be enclosed at the back and sides, and it is customary to have two rows of stalls, an outer one set immediately on the floor or with a few inches elevation in order that a wooden floor may be put above the stone floor of the church, and a second row behind, perhaps two steps higher. Where a row of stalls is very long there may be an opening or more openings than one in the front row, made by the omission of a seat, and intended for access to the back row.

As the occupant of a stall sometimes sits and sometimes stands for a length of time during the service, it is common to arrange a hinged seat easy to lift and to lower again, and made heavy so as to be firm. Such a seat is usually carved out of a solid mass of heavy wood, the boss underneath which gives it weight and balances it on the hinges, being often an elaborate representation of a cluster of leaves, a human figure or a group of several figures, or a monstrous animal. Such bosses are called misericordes or sometimes misereres.

The most elaborate stalls known are those of the Cathedral of Amiens, magnificent joinery and carving of about 1510. RUSSELL STURGIS.

Stallo, John Bernard, German-American jurist and scientist: b. in Grand Duchy of Oldenburg, Germany, March 1822; d. Florence, 5 Jan. 1900. He received a liberal education in Germany and came to America when 16. Was professor of Latin and Greek in St. Xavier's College, Cincinnati; was also proficient in English, German, Dutch, French, Spanish, Italian and Hebrew. After two years at St. Xavier's he was made professor of Latin in St. John's College, New York, and while there studied law. He returned to Cincinnati in 1847 to practice law, and sat upon the Common Pleas bench of Hamilton County in the fifties. In 1885 Judge Stallo was appointed minister to Italy by President Cleveland, but upon the election of Harrison he resigned and lived in Florence until his death. The last 15 or 20 years of his life were largely devoted to the study of philosophy. He published: 'General Principles of the Philosophy of Nature,' 'The Concepts and Theories of Modern Physics,' and 'Abhandlungen und Briefe.'

JOSEPH WILBY,
President Historical and Philosophical Society of Ohio.

Stalwarts. See REPUBLICAN PARTY.

Stalybridge, stā'lĭ-brĭj, England, in the counties of Lancaster and Chester, about seven miles east of Manchester, on the Tarne, stands in a barren district on slopes rising from both banks of the river. The public buildings include the town hall, free library, several churches, and

Digitized by Google

post-office. The manufacture of cotton goods is considerable, occupying many thousand hands. Besides, there are foundries, machine shop, and millwright works. The importance of the town dates from 1776.

Stamboul, stäm-bool'. See CONSTANTINOPLE.

Stambuloff, stäm-boo'lof, **Stephen Nikolof,** Bulgarian statesman: b. Tirnova 1853; d. Sofia 18 July 1895. He took part in the rising of 1875–6, and as an office-holder during the occupation by the Russians, following the war of 1878, became prominent as a leader of the radical party in the new national assembly. He was a conspicuous member of the regency which followed the abdication of Prince Alexander, strongly opposed to the adherents of the Russians, and when he became premier in 1878, after the election of Ferdinand, ruled with scant regard for prince or legislature. He was forced to retire in 1894; his death the next year was the result of an attack by assassins.

Stamford, stăm'fōrd, Conn., city in Fairfield County; on Long Island Sound and Mill River, and on the New York, New Haven & Hartford railroad; about 75 miles southwest of Hartford and 35 miles northeast of New York. The harbor is large enough for large Sound vessels. The city has regular steamer connection with New York, and electric lines extend to all the nearby cities and towns.

Stamford was settled in 1641 by a colony from New Haven. An Indian village named Rippowam had existed here, but the name was changed in 1642. It was incorporated as a borough in 1830, and in 1894 was chartered as a city. The surrounding country is devoted mainly to agricultural, but the city has large manufacturing interests, and is the commercial centre of an extensive region. The chief establishment is the Yale & Towne Manufacturing Company, which regularly employs about 2,500 persons. Other manufactures are extracts, typewriting machines, woolen goods, lumber, hats, shoes, machine shop products, pottery, dyestuffs, patent medicines, chemicals, hardware, and wagons and carriages. The government census of 1910 gives the number of manufacturing establishments as 86; the amount of capital invested, $11,926,000; the cost of material used annually, $3,704,000; and the value of the product, $8,740,000. There are a number of small parks in different parts of the city; three in the residential section. The water supply comes from Trinity Lake in New York State. There is an excellent sewerage system and a paid fire department. There are a large city hospital, Saint John's Hospital and Home, and several private sanatoriums. The educational institutions are a high school (new building erected in 1895), the diplomas from which entitle the holders to entrance to several universities and colleges; nine large elementary schools, one large parish school, the Catherine Aiken School for girls, the Betts Academy, founded in 1838, for boys; Misses Low and Heywood School, the King School, and the Manor School at Shippan Point. The Ferguson Library is housed in a fine building. The three banks have a combined capital of $602,020; there is also one private bank. The government as at present constituted is administered under a charter which provides for a mayor and a common council, elected biennially in even years. Appropriations are in charge of a Board of Appropriation. The population in 1910 was 25,138.

Stamford, England, in the counties of Lancashire and Northampton, on the Welland, 12 miles northwest of Petersborough. The main buildings are: St. Mary's Church (13th century), All Saints, St. Martin's, St. John the Baptist's (15th century), town hall, corn exchange, assembly and club rooms, literary institute, Browne's hospital (15th century), school and charitable institutions. The manufacture of agricultural implements, and breweries, are the chief sources of industry and trade.

Stammering, a defect of speech due to failure in co-ordinate action of certain muscles and their appropriate nerves. It is analogous to some kinds of lameness to cramp or spasm, or partial paralysis of the arms, wrists, hands, and fingers, such as is sometimes attendant upon certain exercises (see OCCUPATION, HYGIENE OF); for speech is a muscular act involving the co-ordinate action of many nerves and muscles.

The words stammering and stuttering practically denote the same infirmity, although stuttering is now limited more or less to the futile repetition of sounds, while stammering covers the whole defect — the hesitation, glide, stop, holding on to the sound, as well as repeating it. When stammering is proved to be pretty widespread in Prussia, Great Britain and its colonies, and the United States, and uncommon in Italy and Spain, the question suggests itself whether languages of Teutonic origin are not more apt to generate it than languages of Latin origin. This chief of the imperfections of speech may be hereditary, and it may be acquired by imitation. Like yawning, it is infectious. It may be the abiding result of mental strain or shock. Fever may bring it on, epilepsy, hysteria, or any serious nervous affection or strong emotion, temporary failure of health, any excitement, or even soreness of the mouth. It rarely shows itself earlier than at four or five years of age. It usually begins in youth, but may be produced at any later age. A much larger proportion of males than of females stammer. Stammering used to be ascribed exclusively to the organ of articulation, the mouth; to faulty setting of the teeth or the jaws, to the largeness and thickness of the tongue, its weakness of movement, its excessive vigor, etc. At present in the research for the cause and cure of stammering full account is taken of the vocal cords or cushions and the vocal chink.

Stammering occurs in the mouth, the organ of articulation. Its proximate cause is always in the larynx, the organ of voice. Sometimes the lungs, the organ of breathing, complicate the uncertainty and unsteadiness of the vocal cords and the vocal chink in the larynx. A current of air, variously shaped by the mouth as a whole, is what is called a vowel. A stammer on a vowel can only take place in the vocal chink, rima glottidis. The sounds called consonants are produced by closures, more or less firm, of contents of the mouth. Thus, *b, p, m, w,* by the closure of the two lips; *f, v,* of the lower lip and upper teeth; *g* soft and *sh,* of the teeth; *l* and *th,* tongue and upper teeth; *t, d, n, s, z, y,* tip of the tongue and fore gum; *g* hard and *k,* back edges of the tongue and back gum. Stammering may occur at any of these six

Digitized by Google

closures. It is, perhaps, most apt to occur at the labials *b, p,* the dentals *d, t,* the gutturals *g* hard, *k,* because for these the closure is firmest. The stammerer has no difficulty in setting lips, teeth, tongue, and gums against each other as required. His difficulty is to relieve the closure, to get at the vowel which is to follow the consonant. The tongue, for example, will not part with the teeth — seems to cling spasmodically to them — because the current of air, the vowel, does not come at the proper instant through the vocal chink to relieve it. In this way the three observable modes of stammering are explained. If the vocal chink does not open soon enough there is a stop stammer; if it flutters, there is a stutter; if it opens too soon, there is a glide stammer. But, further, the lungs expand and contract by nervous and muscular energy; and, besides, the muscular and nervous machinery of the breastbone, ribs, midriff, and upper abdomen are all concerned in that expansion and contraction. These complicated and delicate bellows which supply air under pressure to the organ of voice may be defective, out of order, misused. Their working is to be closely observed in the case of each stammer. Stammerers, as a rule, breathe badly. They constantly try to speak when their lungs are empty.

Stammering can be cured. It often disappears gradually without effort at cure. Improvement generally takes place as age advances. In some cases resolute endeavor is demanded. A waving motion of the arms, time kept to a baton were favored as cures at one time. They were on the lines of the musical methods of cure — intoning, chanting, singing — which were based on the fact that most stammerers can sing without difficulty. The stammerer should be taught to regulate the breath, and he should work for a habitual use of the chest voice — for deeper, steadier vibration of the vocal cords — since stammering usually occurs with use of a head voice. The stammerer should take exercise in a chest voice, on the sounds (seldom vowels) at which a stumble is apt to be made.

Stamp Act, an act for regulating the stamp duties to be imposed on various documents. In 1765 George Grenville, chancellor of the English exchequer, proposed a bill for taxing the colonies through a stamp duty. No serious opposition was expected. But the measure aroused great excitement in America as an attempt at taxation without representation. In the United States a Stamp Act congress consisting of delegates from all the colonies except New Hampshire, Virginia, North Carolina, and Georgia, met at New York 7 Oct. 1765, and adjourned 25 October. The action of this congress consisted of an address to the king, petitions to Parliament and a declaration of the rights and grievances of the colonies. It protested that the colonies could only be taxed by their own representatives in the colonial assemblies; claimed the inherent right of trial by jury, and declared the Stamp Act to have a manifest tendency to subvert the rights and liberties of the colonies.

Stamp Collecting. See PHILATELY.

Stamp Duty. See DUTY; TAX.

Stamp-mill, a crushing mill or machine for pulverizing ores and rocks. In Western mining camps the stamp-mill is usually worked by water power. See MINES AND MINING.

Stamping of Metals. See DIE AND DIE-SINKING.

Stamps, Postage. See PHILATELY; POST AND POSTAGE.

Stand-pipe, (1) in machinery, a boiler supply pipe of sufficient elevation to enable the water to flow into the boiler notwithstanding the pressure of the steam. Stand-pipes are also used on the eduction pipes of steam pumps to absorb the concussions arising from pulsations and irregularities, caused by the unavoidable employment of bends and change in the direction of pipes. (2) In hydraulic engineering, a stand-pipe is a curved vertical pipe, arranged as a part of the main in waterworks to give the necessary head to supply elevated points in the district, or to equalize the force against which the engine has to act.

Standard. See ENSIGN; FLAG.

Standard, Battle of the, in English and Scottish history, a battle in which David I. of Scotland, who had espoused the cause of Maud against Stephen, was signally defeated by the English under the Bishop of Durham. It was fought in the neighborhood of Northallerton, in Yorkshire, on 22 Aug. 1138, and it got its name from the fact that the English forces were gathered round a tall cross mounted on a car, and surrounded by the banners of Saint Cuthbert, Saint Wilfred, and Saint John of Beverley. A peace was concluded between the two countries in the following year, David acknowledging the claims of Stephen to the throne of England.

Standard Time. See TIME.

Standard Unit of Value. See FINANCE.

Standards of Length, Mass, and Time. Standards of length, mass and time are the fundamental units used alike in the business of daily affairs and in the measurements and calculations of physical science.

The most important standards of length now used are the British yard and the international prototype metres. Both of these are legal standards in the United States, the metric system having been legalized in 1866. The relations of the yard and metre are shown by the following equations:

1 yard = 0.9143992 metres.
1 metre = 1.093614 yards.
1 metre = 3.280843 feet.
1 metre = 39.37011 inches.

The most important standards of mass now used are the British pound and the international prototype kilograms. Both are legal standards in the United States. The relations of the pound and kilogram are shown by the following equations:

1 pound = 0.4535924277 kilograms.
1 kilogram = 2.20462234 pounds.

The above relations of the yard and metre and the pound and kilogram are the precise values determined by the International Bureau of Weights and Measures. The relations which have been legalized in the United States are:

1 metre = 39.37 inches.
1 kilogram = 2.2046 pounds.

The unit of time adopted by common consent, but used more especially in physical science, is the mean solar second, or 1-86400th part of the mean solar day. The minute, the hour, the day, etc., also in common use, are multiples of the

Digitized by Google

mean solar second. The latter is derived, however, from the time of rotation of the earth, or from the interval between two successive transits of a fixed star across any meridian plane. This interval is called the sidereal day, and it is equal in length to 86,164.1 mean solar seconds. See WEIGHTS AND MEASURES.

Standing Stones. See STONES, STANDING.

Stan'dish, Myles, English colonist in America: b. Lancashire about 1584; d. Duxbury, New England, 3 Oct. 1656. Prior to 1603 he had gained a lieutenancy in the English force then serving in the Netherlands, but after the truce of 1609 joined the Puritan colony at Leyden, though he never belonged to that communion, and sailed in the Speedwell and Mayflower. By reason of his experience in martial affairs, Standish was made military adviser to the colonists, and upon their arrival in America he headed exploring and scouting parties. In February 1621 he was chosen unanimously military captain of the colony. His force was always small, though recruited 11 November, and of the numbers and method of warfare of the Indians he knew nothing. But his demonstrations of power soon resulted in some degree of alliance with the powerful tribes along the coasts of Massachusetts Bay. In 1622 Thomas Weston established at Wessagusset (the present Weymouth) an independent settlement which quickly was involved in difficulties with the Indians. A great conspiracy of the savages was thereupon formed, the design being to destroy Plymouth after Weston had been similarly treated. Standish, with a file of eight, marched to Wessagusset, killed the hostile chiefs Pecksuot and Witawamat, defeated the Indians in battle, and thus greatly increased the prestige of the struggling colony. He went to London in 1625, to adjust disputes arising with certain merchants who had advanced money on the colony's enterprise, and who at last abandoned their claims on payment of £1,800. In 1628 he arrested Thomas Morton (q.v.), whom he wanted to have shot. The last actual conflict in which he took a part was that in 1635, when he unsuccessfully attempted to dispossess the French who had seized a trading-post established by the colonists on the Penobscot. Besides his military commission, he held also the posts of assistant to the governor, and, from 1644 to 1649, of treasurer of the colony. He was active and soldierly, and by his ability contributed very greatly to decide the success of the settlement. Longfellow's 'Miles Standish' contains numerous anachronisms and inaccuracies. Lowell, also, wrote an 'Interview with Miles Standish.' In 1872 the corner-stone of a monument 110 feet high and surmounted by a bronze figure of Standish was laid at Duxbury. Consult: Bradford, 'History of Plimouth Plantation' (Dean's ed. 1856); Morton's 'New England's Memorial' (ed. 1855); Johnson, 'Exploits of Myles Standish' (1897); and various works of authority dealing with the history of the colony.

Stanfield, stăn'fēld, **William Clarkson,** English painter: b. Sunderland 3 Dec. 1793; d. 18 March 1867. He began life as a sailor; occupied his spare time in sketching; received an engagement to paint scenery for the Old Royalty Theatre, London; became scene painter at Drury Lane in 1826; was elected a member of the Society of British Artists, and abandoned scene-painting in 1830. Among his pictures may be mentioned: 'Mount Saint Michael' (1831); 'The Battle of Trafalgar' (1836); 'The Body of Nelson towed into Gibraltar' (1853); 'The Abandoned' (1856).

Stanford, stăn'fōrd, **SIR Charles Villiers,** English composer: b. Dublin 30 Sept. 1852. He was educated at Cambridge, and continued his musical studies at Leipsic and Berlin. In 1877 a festival overture in B flat by him was performed at the Gloucester Festival, and a symphony at the Crystal Palace. Since that date he has produced numerous compositions in different styles, several of which have achieved a considerable degree of popularity. His best-known work is probably his choral setting of Tennyson's ballad of 'The Revenge,' which was produced at the Leeds Festival in 1886. His operas include 'The Veiled Prophet of Khorassan' (1881); 'Savonarola' (1884); 'Shamus O'Brien' (1896); and 'Much Ado About Nothing' (1901). In oratorio he has produced 'The Three Holy Children' (1885), and 'Eden' (1891), both written for Birmingham Festivals. His symphonies are: an 'Elegiac Symphony' (1882); an 'Irish Symphony' (1887); a 'Symphony in F' (1888); and 'L'Allegro ed il Penseroso' (1895). The most important of his other works may be thus enumerated: a setting of Whitman's elegiac ode on the death of Lincoln (1884); settings of the three cavalier songs by Browning (1884); music for Æschylus' 'Eumenides' (1885) and Sophocles' 'Œdipus Rex' (1887); settings of some psalms; a violin suite (1888); 'The Battle of the Baltic' (1891), a ballad for chorus and orchestra; string quartets; pianoforte sonatas; an ode on the opening of the Chicago exhibition, the words being by Swinburne; masses, and Irish fantasies for the violin (1894). On the foundation of the Royal College of Music, in 1883, Dr. Stanford was appointed professor of composition and orchestral playing, and in 1887 professor of music at Cambridge. He was knighted in 1902.

Stanford, Jane Lathrop, American philanthropist: b. Albany, N. Y., 25 Aug. 1825; d. Honolulu, Hawaiian Isl., 28 Feb. 1905. She was married to Leland Stanford (q.v.) and since his death in 1893 has been occupied chiefly in fostering the development and extension of Leland Stanford Jr. University, which she had aided her husband to establish in memory of their son. In 1901 she increased her gifts to the university by further gifts of securities valued at $18,000,000; her residence in San Francisco, valued at $400,000, for a museum and art gallery; and 1,000,000 acres of land valued at $12,000,000. She has subsequently added other benefactions, thus making the university the wealthiest educational institution in the world. Mrs. Stanford established the children's hospital at Albany, N. Y., at a cost of $100,000, and provided an additional $100,000 to secure its maintenance; she has likewise given over $160,000 to various schools and kindergartens. See LELAND STANFORD JR. UNIVERSITY.

Stanford, Leland, American capitalist and philanthropist: b. Watervliet, Albany County, N. J., 9 March 1824; d. Palo Alto, Cal., 21 June 1893. He studied law and commenced its practice at Port Washington, Wis., but in 1852

Digitized by Google

went to California and engaged in mining for four years. In 1856 he founded a business in San Francisco which became the nucleus for a fortune estimated at over $50,000,000. In 1860 he entered public life as a delegate to the convention that nominated Abraham Lincoln for the Presidency. About this time he became president of the Central Pacific Railroad, an enterprise in which he was deeply interested financially. He was governor of California 1861–3; and United States Senator 1885–91. He did much to promote the agricultural development of California and to increase its transportation facilities, but he will probably be longest remembered, however, as the founder of Leland Stanford Jr. University, for which he made an initial gift of $20,000,000. This work, begun in commemoration of his son, has been continued by his wife, Jane Lathrop Stanford (q.v.), who has erected at Palo Alto a beautiful and costly memorial church to his memory. See LELAND STANFORD JR. UNIVERSITY.

Stang, William, Roman Catholic bishop of Fall River, Mass.: b. Langenbruchen, Germany, 21 April 1854; d. Rochester, Minn., 2 Feb. 1907. Received his primary education in the German Gymnasia and his philosophical and theological training at the American College, Louvain. Ordained priest in Mechlin, 15 June 1878, and came to Providence, R. I., in October of the same year. Was successively assistant and rector of the Cathedral, pastor of Saint Ann's and Saint Edward's parishes, and superior of the Diocesan Missionary Band. He was consecrated first bishop of Fall River in the Cathedral, Providence, 1 May 1904. Among his best known works are: 'Life of Martin Luther'; 'The Eve of the Reformation'; 'More About the Huguenots'; 'Germany's Debt to Ireland'; 'Pastoral Theology'; 'Historiographia Ecclesiastica'; 'Theologia Fundamentalis Moralis'; 'Spiritual Pepper and Salt.'

Stanhope, stăn'ŏp, an English family, to which three peerages belong: Chesterfield (barony of Stanhope from 1616, and earldom of Chesterfield from 1628); Stanhope (barony, 1717; earldom, 1718), and Harrington (barony, 1729; earldom, 1742). James, 1st Earl Stanhope: b. Paris 1673; d. London, England, 5 Feb. 1721. He entered the army, and served as brigadier-general at the capture of Barcelona in 1705. In 1708 he was appointed commander-in-chief of the British forces in Spain, and in the same year he took Port Mahon, and thus made himself master of the Island of Minorca. After the accession of George I. he devoted himself to politics, and became the favorite minister of that monarch, to whom he owed his titles of baron and earl. Charles, the 3d earl, grandson of the preceding; b. London 3 Aug. 1753; d. Chevening, Kent, 15 Dec. 1816. He was an inventor and a patron of science. He approved the French Revolution, openly avowing republican sentiments, and as a member of the House of Lords he favored parliamentary reform, the abolition of negro slavery, the freedom of the press, and the independence of juries. He was father of the celebrated Lady Hester Stanhope (q.v.). The 5th Earl Stanhope (1805–75), grandson of the last noticed, was author of a 'History of England from the Peace of Utrecht to the Peace of Versailles' (1713–83).

Stanhope, LADY **Hester Lucy,** eccentric English woman, daughter of the 3d Earl Stanhope (q.v.): b. Chevening, Kent, 12 March 1776; d. near Sidon, Syria, 23 June 1839. Her own home was uncongenial and in 1803 she went to preside over that of her uncle, William Pitt, becoming his most trusted confidant. After his death in 1806 she received a pension, but her life being much embittered by her loss of power through his death, and saddened also by the death of her favorite brother and a lover, she left England in 1810, and after traveling over various parts of the East, settled in Syria, where she resided for the rest of her life, living latterly about eight miles from Sidon, at a villa of her own construction, called D'Joun, which was situated on a solitary mountain, remote from any village. The rich presents which she made to the Turkish pashas gave her a great influence over them for a time, though it was afterward greatly diminished. The Bedouins, however, or wild Arabs, whom her wisdom and kindness had won, still continued to look up to her, not only as a benefactor, but as a being of a superior order. She is "the crazy Queen of Lebanon" to whom Whittier alludes in 'Snow-bound.' Her guests also included Lamartine (1832) and Kinglake (1835). Consult: Kinglake, 'Eothen'; Meryon, 'Memoirs of Lady Hester Stanhope' (1846).

Stanislaus, stăn'ĭs-lâs, or **Stanislas I. Leszczynski,** lĕs-chŭn'skē, king of Poland: b. Lemberg, Galicia, 20 Oct. 1677; d. 23 Feb. 1766. In 1704, being then woywode of Posnania, and general of Great Poland, he was deputed by the assembly of the states at Warsaw to wait upon Charles XII. of Sweden, who invaded the kingdom with the view of dethroning Augustus of Saxony. Charles immediately resolved to raise him to the throne of Poland, which he effected at an election held in July 1704. He was, however, soon after driven from Warsaw by his rival Augustus; but another change brought him back to that capital, where he was crowned with his wife, in October 1705; and the next year Augustus was compelled formally to abdicate. The fatal defeat of his patron, Charles XII., at Pultava, in 1709, again obliged him to retreat into Sweden, where he endeavored to join Charles at Bender, in disguise; but, being detected, he was held captive in that town until 1714. He remained in obscurity until 1725, when his daughter, the Princess Mary, was selected as a wife by Louis XIV., king of France. On the death of Augustus, in 1733, an attempt was made by the French court to replace Stanislaus on the throne of Poland; but, although a party supported him and proclaimed him king, his competitor, the electoral Prince of Saxony, being aided by the emperor of Germany and Russia he was obliged to retire. He endured this, like every other reverse of fortune, with great resignation, and, at the peace of 1736, formally abdicated his claim to the kingdom of Poland, on condition of retaining the title of king, and being put in possession for life of the duchies of Lorraine and Bar. Thenceforward he lived as the sovereign of a small country, and acquired the appellation of "Stanislaus the Beneficent." He not only relieved his people from excessive imposts, but, by strict economy, was able to found many useful charitable establishments, and to

Digitized by Google

patronize the arts and sciences. He wrote some treatises on philosophy, morals and politics, which were published under the title of 'Œuvres du Philosophe bienfaisant' (8vo, 1765).

Stanislaus, or Stanislas II., Augustus, the last king of Poland, son of Count Stanislaus Poniatowski: b. Woczyn, Lithuania, 17 Jan. 1732; d. Saint Petersburg 12 Feb. 1798. In 1752 he first appeared as a deputy in the Polish diet, where he soon attracted attention by his oratory. Augustus III. sent him on a mission to the Empress Elizabeth at Saint Petersburg, and on this occasion he acquired the peculiar favor of the Princess (afterward Empress) Catharine. After the death of Augustus, the influence of Catharine secured the election of her favorite as his successor (Sept. 1764), and he was crowned at Warsaw on the 25 Nov. 1764. Although of excellent ability and noble disposition, he was yet unable to do anything for the good of his country, because he lacked the strength of character necessary to check the license of the nobles, and to withdraw himself from Russian influence. In 1772, when the first partition of Poland was made, Stanislaus in vain protested against it, while his resistance to the second partition of Poland had only this consequence, that after the capture of Warsaw the Empress Catharine caused him to be brought to Grodno, where he was compelled to sign the treaty for the third partition of Poland, and on the 25th of November 1795, also to sign his own abdication. After the death of Catharine, Paul I. brought him to Saint Petersburg, where he lived for the rest of his life on a pension allowed him by the emperor. Consult, 'Memoires secrets et inédits de Stanislas' (1862).

Stanley, stăn'lĭ, **Arthur Penrhyn,** English Anglican clergyman: b. Alderley, Cheshire, 13 Dec. 1815; d. London 18 July 1881. He was educated first at Rugby, where he conceived an abiding love and veneration for Dr. Thomas Arnold (q.v.), and gained a unique position in the school. In 1834 he entered Balliol College, Oxford, where he had a brilliant career, and in 1838 was elected a fellow of University College. He took deacon's orders in 1839 and priest's in 1843, became a college tutor in 1843, and was appointed in 1845 preacher to Oxford University. In that capacity he preached four sermons, which were published as 'Sermons on the Apostolic Age,' in 1847, at a critical time in the religious history of Oxford. In these Stanley stood aloof from both the evangelicals and the high churchmen, taking, rather, a rationalistic position. He was presented to a canonry of Canterbury in 1851, and shortly afterward traveled extensively in Palestine and Egypt. In 1856 he was appointed professor of ecclesiastical history at Oxford and canon of Christ Church, and in 1823 was made dean of Westminster. In this position, as the acknowledged head of the Broad Church party, he exercised an important influence, though the width of his sympathy and his tolerant spirit exposed him to attacks from many of narrower views within the Anglican Church. In 1863 he married Lady Augusta Bruce, daughter of the 7th Earl of Elgin (died 1876), to whom he owed much of his social popularity. He visited this country in 1879 and showed especial courtesies to American visitors to Westminster Abbey. He was the author of numerous works, among which are: 'Life of Arnold' (1844); 'Memoir of Bishop Stanley,' his father (1850); 'Memorials of Canterbury Cathedral' (1854); 'Commentary on the Epistles to the Corinthians' (1855); 'Sinai and Palestine' (1856); 'Three Introductory Lectures to the Study of Ecclesiastical History' (1857); 'Lectures on the History of the Eastern Church' (1861); 'Lectures on the History of the Jewish Church' (1863-76); 'Sermons in the East' (1863); 'Memorials of Westminster Abbey' (1868); 'Essays, on Questions of Church and State' (1870); 'The Athanasian Creed' (1871); 'Lectures on the History of the Church of Scotland' (1872); 'Addresses and Sermons delivered at St. Andrews' (1877); 'Addresses and Sermons delivered in the United States and Canada' (1879); 'Christian Institutions' (1881). The breadth and tolerance characteristic of Stanley's religious views were well shown in his attitude towards Bishop Colenso, whom he supported without endorsing his opinions on the Pentateuch, and in his article on the famous 'Essays and Reviews' contributed to the 'Edinburgh Review' of April, 1861. Consult: Bradley, 'Recollections of Arthur Penrhyn Stanley' (1883); Prothero, 'Life and Correspondence of Dean Stanley' (1893), and 'Letters and Verses of Dean Stanley' (1895).

Stanley, David Sloane, American soldier: b. Chester, Ohio, 1 June 1828. He was graduated from West Point Military Academy 1852. As an officer in the Federal army he took an active part in the Civil War, especially in the battle of Corinth and in the battles of the Atlanta campaign. He was promoted brigadier-general U. S. A. in 1884, and was retired 1892.

Stanley, Sir Henry Morton, Anglo-American explorer: b. near Denbigh, Wales, 28 Jan. 1841; d. London 10 May 1904. His name was originally John Rowlands and at 3 he was placed in the poorhouse at Saint Asaph, where he remained for 10 years, making such progress that when he left the institution he was engaged as an instructor for other children at Mold, Flintshire. In 1857 he sailed as cabinboy on a vessel bound for New Orleans, where he was adopted by a merchant who gave him his name, but who died without making a will, thus leaving his adopted son penniless. At the outbreak of the Civil War Stanley entered the Confederate army but was shortly afterward taken prisoner, and when discharged volunteered in the United States navy and later became acting ensign on the ironclad "Ticonderoga." At the close of the war he went to Turkey and Asia Minor as a newspaper correspondent, and in 1867-8 was engaged as special correspondent for the New York *Herald* on the Abyssinian expedition, winning a reputation as a journalist by sending his account of Lord Napier's victory to London in advance of the official despatches. He represented the same paper in Spain during the Carlist war in 1868 and in 1869 accepted the mission from the proprietor of his paper "to go and find Livingstone," from whom no tidings had come for more than two years. He was given full control of the expedition and after attending the opening of the Suez Canal, visiting Constantinople, the Crimea, Palestine, the valley of the Euphrates, Persia, and India, he set sail from Bombay, for Africa, 12 Oct. 1870. He reached Zanzibar on the eastern coast of Africa in January 1871, organized

Digitized by Google

an expedition of 192 men, divided them into five parties, and set out on 21 March. He found Livingstone at Ujiji on Lake Tanganyika, 10 Nov. 1871, and remained with him four months, after which, the veteran explorer refusing to abandon his enterprise until it was completed, Stanley furnished him with supplies and returned to England. In 1874 Stanley set out on a second African expedition under the auspices of the New York *Herald* and the London *Daily Telegraph*. Reaching Zanzibar in the autumn of that year, he learned of Livingstone's death, and resolved to shape his course to the northwest. He explored the equatorial lake region, circumnavigated for the first time Victoria Nyanza, proving it to be the largest fresh-water lake in the world instead of a series of lagoons, discovered the Shimeeyu River, and afterward, continuing to the westward discovered that Albert Nyanza was not connected with Lake Tanganyika as had been supposed. He returned to England in 1878 having on his return journey traced the Kongo River from its source to its mouth. In 1879 he again set out for Africa on the Belgian enterprise, which resulted in the development of the Kongo Free State. He visited the United States in 1886 on a lecturing tour and in 1887 organized the relief expedition in search of Emin Pasha whom he met on the Albert Nyanza 28 April 1888 and escorted him to the east coast, discovering the Ruwenzori Mountains south of Albert Nyanza on the return trip. He reached England in 1890, visited the United States and Australia, on lecturing tours in the following year and in 1895–1900 sat in Parliament for North Lambeth. He was knighted in 1899. His publications include: 'How I Found Livingstone' (1872); 'Through the Dark Continent' (1878); 'The Congo, and the Founding of its Free State' (1885); 'In Darkest Africa' (1890); 'Through South Africa' (1898); etc.

HARRIET BRUNKHURST,
Editorial Staff, 'Encyclopedia Americana.'

Stanley, Thomas, English scholar: b. Comberlow, Hertfordshire 1625; d. London, 12 April 1678. He was graduated at Cambridge in 1641, but held also a master's degree at Oxford. He entered the Middle Temple and practised law all his life, but is best known as a scholar. His works include translations from the Greek, Latin, French, Spanish, and Italian poets; the 'History of Philosophy' (1655–62), dealing with the Greek philosophers; and an edition of Æschylus (1663–4), with Latin translation and commentary. These two works long remained standards, the latter being translated into several languages.

Stanley Falls, Kongo Free State, a cataract and an important trading station on the Kongo River about 1,400 miles from its mouth; also an administrative district of the Kongo State.

Stanley Pool, Kongo Free State, a lake-like expansion of the Kongo River 325 miles from its mouth, and about 80 square miles in area. It was discovered in 1877 by Stanley, who founded here the station of Leopoldville, which became the principal base for trade and exploration in the Kongo Basin. Stanley Pool is also the name of an administrative district of the Kongo State.

Stannard, stăn'ard, **Henrietta Eliza Vaughan Palmer** («JOHN STRANGE WINTER,» «VIOLET WHYTE»), English novelist: b. York, England, 13 Jan. 1856. She was married to Arthur Stannard in 1884. She has been a prolific writer since her first appearance in print in 1874, her novels numbering above 50. She was the first president of the Writers' Club in 1892. Among her works, chiefly tales of army life, are: 'Cavalry Life' (1881); 'Bootles's Baby' (1885); 'A Siege Baby' (1887); 'Heart and Sword'; 'A Blaze of Glory'; 'Uncle Charles,' etc.

Stan'naries, mines from which tin-bearing ore is dug. The most noted stannaries are those of Devon and Cornwall in England. Around the mines of these two counties there has arisen a body of law and customary usage peculiar to the locality and not imitated or duplicated in any other mines in England. By early usage the prerogative of the crown was extended so as to cover these tin mines, although elsewhere it reaches only to gold and silver. King John in a charter to the tinners gave them the privilege of mining and working anywhere in the two counties and this was confirmed by subsequent monarchs, until Edward III. created his son Duke of Cornwall with the stannaries as a perpetuity of the duchy. The Duke who is now always the Prince of Wales is represented by a warden and vice wardens. In former times representative assemblies of the tinners (called parliaments) were summoned by the warden for the regulation of the stannaries and redress of grievances: the last of them was held in 1752. The Stannary Courts are courts of record held by the warden and vice-warden (of the same limited and exclusive character as the courts-palatine), in which the tinners have the privilege of suing and being sued. They were remodeled and regulated by a series of acts of Parliament. Appeals from them are now taken to the Court of Appeals, and finally to the House of Lords.

Stan'nite, or **Tin Pyrites,** a metallic mineral frequently bronze-like and therefore called «Bell Metal Ore» by the miners of Cornwall, England, its chief locality. It was only known massive until recently discovered in small tetrahedral crystals in Bolivia. Its hardness is 4; specific gravity 4.3 to 4.5; streak blackish; color steel-gray to iron-black. It is a sulphide of tin, copper, iron and some zinc. It contains 27.5 per cent of tin, and 29.5 per cent of copper and is therefore valuable as an ore of these metals.

Stanovoi (stä-nō-voi') **Mountains,** Siberia, a mountain range traversing eastern Siberia from the northern boundary of Mongolia to the Bering Strait. Its general course is northeast, but after traversing the Transbaikal district and running along the northern boundary of the Amur district, it skirts the shores of the Sea of Okhotsk in a large zigzag. It terminates in East Cape on the Bering Strait. Its total length is about 2,600 miles. The southwestern portion, which is known as the Yablonoi Mountains, is less regular than the northern branch and spreads out into numerous parallel chains and transverse spurs. This part is heavily forested, while the forests disappear north of the 60th parallel. The Stanovoi range proper is a steep mountain-wall with rugged peaks reaching a height of over 8,000 feet. The whole range forms the divide between the Arctic and Pacific oceans, and feeds the Yenisei, Lena, Indigirka, Kolyma and Amur rivers.

Digitized by Google

Stanton, Edwin McMasters, American statesman and jurist: b. Steubenville, Ohio, 19 Dec. 1814; d. Washington, D. C., 24 Dec. 1869. His paternal ancestors were Quakers originally from Massachusetts but later settled in North Carolina, and his mother was a Virginian. At the age of 13 upon his father's death he began to work, and at 17 entered Kenyon College but was obliged to leave after two years for lack of means. After three years of study he was admitted to the bar in 1836 and married.

He joined the Democratic party on the issue of nullification, and in 1837 was elected prosecuting officer of his county. After serving for two years he returned to private practice, and in 1847 he moved to Pittsburg where he soon took rank among the leaders of the Pennsylvania bar. In 1856 he changed his residence to Washington, and in 1858 was sent to California as special counsel of the United States in the cases growing out of land grants made by the Mexican Government before the treaty of 1848. He added greatly to his reputation by his conduct of this litigation. During these years he took no part in politics but sympathized with the Free-soil wing of the Democratic party and favored the Wilmot Proviso. In 1856 he supported Buchanan, and in 1860 voted for Breckenridge, believing that the election of Lincoln would imperil the Union.

When Buchanan's cabinet divided in December 1860 and Cass, the secretary of state, resigned, Attorney-General Black took his place and Stanton was made attorney-general 20 Dec. 1860, the day when the ordinance of secession was adopted in South Carolina. At his first cabinet meeting the question was presented whether Major Anderson should be ordered back to Fort Moultrie. Floyd, the secretary of war and his Southern associates insisted that this should be done, while Stanton with Black and Holt vigorously opposed them, threatening to resign if such orders were issued. Their attitude drove the secessionists from the cabinet and redeemed the close of Buchanan's administration. During the remainder of the administration he was active in studying the plans of the secessionists and considering how to defeat them and protect Washington. He feared insurrection or assassination to prevent Lincoln's inauguration, and his influence helped to persuade President Buchanan that regular troops should be ordered to Washington.

The attack on Fort Sumter found him a strong supporter of the national authority and outspoken in calling upon all loyal men to stand by the Government. On 13 Jan. 1862, Mr. Lincoln appointed him secretary of war in place of Simon Cameron. Stanton had criticized Lincoln severely, and had not even met him since his inauguration, but Lincoln selected him for his ability and because he was a representative of the Democratic Unionists, whose support was essential. The wisdom of the choice was signally vindicated. The whole system of the War office was inefficient, and reorganization was imperatively demanded. Stanton brought to his work great executive ability, prompt decision and a strong will which made itself felt through the whole military service. He had scant patience with men who were seeking personal advantages, or with frivolous calls upon his attention. Hence his manner was brusque, impatient, and decided, and he made many enemies. His spirit found expression two days after he took office when in an order announcing the victory of Mill Spring, he said: "The purpose of this war is to attack, pursue and destroy a rebellious enemy and to deliver the country from danger menaced by traitors. Alacrity, daring, courageous spirit and patriotic zeal on all occasions, and under every circumstance are expected from the Army of the United States."

He advised the passage of a law authorizing the President to take possession of all the railroad and telegraph lines of the United States, and this was at once enacted. He ordered that all contracts for supplies and munitions be in writing, appointed a commission to investigate and determine what valid contracts were outstanding, and waged vigorous war upon fraudulent contractors. By an order of 14 February he directed the release of all persons who had been arrested on suspicion of disloyal practices, with certain exceptions, upon their giving their parole not to aid the rebellion. From that time such arrests were made only under military authority, which was exercised on the theory that all doubts were to be resolved in favor of the country. His view of his relation to the Army was expressed in an early letter to Assistant Secretary Scott, "the great purpose being to pursue and destroy the rebels wherever they can be found, to capture their cities and strong places, drive them from every State and restore the authority of the Government, I would leave the method of accomplishing that purpose to the generals operating in the field; undertaking to supply every want so far as might be done by the whole power of the country, and rejoicing to reward alacrity and success with every honor at the disposal of the Government." Hence when within a month after he took office General Grant captured Forts Henry and Donelson, Stanton promptly recommended his promotion to be a major-general of volunteers, which was as promptly made. The public inclined to ascribe the credit for these victories to Stanton, but in a public letter he disclaimed at once all share in the glory, which he gave to the men who fought the battles.

Secretary Stanton entered office with entire confidence in General McClellan, and seems to have retained this in spite of McClellan's delay, vacillation and irresolution, till the end of the Peninsular campaign. Yet from an early day various newspapers apparently inspired from McClellan's headquarters charged him with trying to thwart and embarrass that general. Stanton's course was attributed to personal ambition and fear of McClellan's rivalry, but he bore these charges in silence lest any reply should injure the public welfare, and both President Lincoln and he did all in their power to help McClellan to the victory which both so ardently desired. Even after the battle of Fair Oaks Stanton telegraphed him on 11 June:

"Be assured, General, that there never has been a moment when my desire has been otherwise than to aid you with my whole heart, mind and strength since the hour we first met. * * * You have never had and never can have any one more truly your friend or more anxious to suport you or more joyful at the success which I have no doubt will soon be achieved by your arms."

No part of Stanton's career shows more clearly his self-abnegation and devoted loyalty

Digitized by Google

to his country than his patience with McClellan during the first six months of 1862, but the latter's delay in moving his army to the support of Pope, his disregard of orders, and his whole conduct during the critical weeks which preceded Lee's invasion of Maryland at length satisfied Stanton that he should be removed, and in the last days of August he tried to unite the cabinet in recommending this step, but Mr. Lincoln felt that McClellan's popularity and the political situation made it necessary to give him the command of the army. Stanton disapproved this action as did Mr. Chase, but the President took the responsibility. McClellan's conduct of the Antietam campaign, his inexcusable delays and almost direct insubordination increased Stanton's feeling and at length convinced the President, and McClellan was dismissed from active service.

Taking office as a Democrat, Stanton early felt the importance of emancipation as a war measure, and when on 22 July 1862, Mr. Lincoln laid before the Cabinet a proclamation declaring that all slaves in the seceded States should be free on a fixed day, Stanton and Bates, the attorney-general, were in favor of issuing it at once, while Seward and Chase opposed it. Stanton approved the issue of the proclamation after Antietam, and in his annual report made a powerful argument in support of the measure. When in the next year after the defeats of Fredericksburg and Chancellorsville, Lee a second time crossed the Potomac, Hooker was relieved and Meade appointed to the command by Stanton's advice, and during the critical summer and autumn of 1863 he met every emergency successfully.

When it was apparent that General Rosecrans was not in a condition to retain the command, Stanton summoned Grant from New Orleans to Louisville, himself met him there, and after a full conference placed him in command of the Western armies, giving Thomas command at Chattanooga. The immediate success of General Grant in his new command with the crushing defeat of Bragg's army made the whole military situation much clearer, and General Grant's appointment to the command of the army and his removal to Virginia followed as a matter of course. After Appomattox General Sherman agreed upon terms with General Johnston, which provided not only for the surrender of the latter's army but for the settlement of vital political questions, and the agreement was disapproved by the Administration. Stanton stated the reasons in a dispatch to General Dix that the public might understand why General Sherman was overruled. His statement was clear and pungent and while it reflected on General Sherman's discretion in consenting to such an arrangement, the General himself was not criticised. Sherman held Stanton especially responsible for the action of the Government and became very hostile to him.

Nothing in the history of the Civil War is more remarkable than the speed with which the vast armies of the United States were dissolved. On 1 May 1865, a million men were on the rolls of the army. In hardly more than 60 days nearly 700,000 of them were returned to their homes. The grand review of the two great armies held in Washington 22 and 23 May 1865 showed the military force of the United States at its greatest. In little more than a month most of that force was engaged in the labors of peace. Stanton had made this possible.

Stanton remained in the cabinet of President Johnson, and in the struggle between the President and Congress over the policy of reconstruction, sympathized with Congress. He felt that the President's policy meant the return of the disloyal element to power in the Southern States and he could not contemplate such a result without indignation. The partisans of the President demanded his resignation, while the leading Republicans besought him to remain feeling that his presence in the war department was an insurance against violence. His position was extremely disagreeable, but he held it with persistent courage, taking no part in the discussion, and making no public expression of his views. He simply remained at his post and discharged his duty. The Tenure of Office Act had been passed in part to prevent the removal of Stanton. He opposed its passage, advised the President to veto it and desired its defeat after the veto.

This act and the provision that the President should issue orders to the army only through the general of the army, effectually took the control of the army away from the President, and he wished to regain it. When Congress adjourned in the summer of 1867 the President sounded General Grant as to removing Stanton from office. Grant counselled him against it. Thereupon the President asked for Stanton's resignation, which was refused, and the refusal was applauded by the Republican leaders. A week later the President suspended him from office without stating any cause and directed him to turn over all public records and property to General Grant, whom he appointed secretary *ad interim*. Stanton, in reply denied his right to suspend him without legal cause, but under protest obeyed the order. When Congress reassembled in December 1867 the Senate refused to concur in the suspension, and Stanton was thus reinstated. The President was very much irritated and after an interval spent in endeavoring to persuade General Sherman to accept the position, removed Stanton on 21 Feb. 1868 and appointed Lorenzo Thomas secretary of war *ad interim*. Stanton declined to obey this order, the Senate by resolution denied the President's power to remove him, and the House voted to impeach the President. The trial of the President followed and ended on the 26th of May, and during its progress General Schofield had been nominated to the Senate as secretary of war. When the Senate failed to convict the President, Stanton at once retired and the nomination of Schofield was confirmed.

He left the office which he had held for more than six years a comparatively young man, but broken in health by the unremitting toil and anxiety which he had undergone. His income which had been considerable when he took office had been so reduced that he had nothing but his house in Washington, and he was obliged to resume the practice of his profession. He argued several important cases, but his powers were exhausted, and he gradually failed. His last argument was made at a hearing in his own library in December 1869, and he never left the house again. The approaching resignation of Judge Grier made a prospective vacancy on the Supreme Bench and on the recommendation of the leading men in both

Digitized by Google

Houses of Congress President Grant nominated Stanton to the place on 20 Dec. 1869. His nomination was at once confirmed and he lived to feel the pleasure of receiving the only office which he ever desired, but his work was done and he died four days later. A sincere, unselfish, patriotic man, the result of the Civil War was due in no small part to his labors.

MOORFIELD STOREY,
Author 'Life of Charles Sumner.'

Stanton, Elizabeth Cady, American reformer: b. Johnstown, N. Y., 12 Nov. 1815; d. New York, 26 Oct. 1902. She was graduated from Emma Willard Seminary, Troy, N. Y., in 1832 and was married to Henry Brewster Stanton (q.v.) in 1840. Her attention was first attracted to the disabilities of her sex when at 15 she was prepared to enter college and found none in which she could obtain the education which her brothers received. She afterward studied Blackstone, Story, and Kent, and while in London, in 1847, met Lucretia Mott, with whom in the following year she issued the first call for a woman-suffrage convention to be held in her home at Seneca Falls. From that time her career was one long struggle for equal rights for both sexes. The general principles for which she strove were equal educational advantages, equal rights of suffrage and of property, and more intelligent divorce laws. She addressed the New York legislature on the rights of married women in 1854 and again in 1860, advocating divorce for drunkenness. In 1866, she offered herself as a Congressional candidate and for 25 years annually addressed congressional committees in the endeavor to gain a constitutional amendment granting enlarged privileges to women. She was president of the Woman's Loyal League in 1861 and of the National Woman Suffrage Association in 1865–93. She traveled and lectured in all parts of the United States and also made addresses in England, Scotland, and France. Throughout her entire career Mrs. Stanton's personal life was a model of the fulfilment of the duties of a wife and mother, her public career never operating to the neglect of her social and home life. While it can not be said that the purposes for which she contested have been entirely achieved, and while the changes which have been wrought can not definitely be declared the result of the exertions of Mrs. Stanton and her fellow workers, a great change certainly came about in her lifetime. The education within the reach of her brothers but unattainable for herself in her girlhood is now within the reach of any determined girl, and the changes in legislation are even more noticeable. The laws which placed a woman's property absolutely at her husband's disposal have been replaced by those which give her equal rights with him, or possibly superior, since the law recognizes no claim on the woman for family support, and her earnings are her own. The suffrage question is not so far advanced. Four states grant full and nearly 20 partial suffrage but the general indifference and in many cases hostility of women as a class to the use of the suffrage practically nullifies the effect of the laws. Her intellect, energy and perseverance, and her womanly traits made her generally respected, and she accomplished much for her cause. She presided over the first International Council of Women held in Washington in 1888, was one of the founders and afterward editor of 'The Revolution,' and a frequent contributor to English and American magazines. She published: 'Eighty Years and More' (1895); and was joint author of 'The History of Woman Suffrage' (1881-6) and edited 'The Woman's Bible' (1895).

Stanton, Frank Lebby, American journalist and poet: b. Charleston, S. C., 1857. He has been connected with Atlanta, Ga., journals for many years, and it now on the editorial staff of the Atlanta *Constitution*. He has published 'Songs of the Soil'; 'Comes One With a Song' (1898); 'Songs from Dixie Land' (1900); and 'Up from Georgia' (1902).

Stanton, Henry Brewster, American abolitionist: b. Griswold, Conn., 29 June, 1805; d. New York, 14 Jan. 1887. He was prominent in the anti-slavery movements of 1837–41. In 1847 he was admitted to the bar and achieved a high reputation in patent law. In 1858–60 he assisted in the reorganization of the Republican party, and from 1868 was on the editorial staff of the New York *Sun*. He has published 'Sketches of Reform and Reformers in Great Britain and Ireland' (1849); 'Random Collections' (1886).

Stanton, Oscar Fitzalan, American naval officer: b. Sag Harbor, N. Y., 18 July 1834. He was graduated from the United States Naval Academy in 1855, and was in command of the U. S. S. Tioga in the special West India squadron and of the U. S. S. Panola in the Western Gulf blockading squadron, during the Civil War. Passing through regular grades, he was promoted to rear-admiral, and went on the retired list in 1894.

Stanton, Robert Brewster, American civil engineer: b. Woodville, Miss., 5 Aug. 1846. He was graduated from Miami University in 1871, was resident engineer for the Cincinnati Southern Railroad, 1874–80; division engineer for the Union Pacific Railway 1880–84; chief of survey through the Grand Canyon of the Colorado 1889–90. He is the author of 'The Canyons of the Colorado River, for Railway Purposes' (1892); 'The Great Landslides of the Canadian Pacific Railway,' etc. (1898); and of monographs and lectures on the Grand Canyon.

Stanwix, stăn'wĭks, **John,** English soldier: b. 1690; d. Irish Channel December 1766. He entered the army in 1706, was made lieutenant colonel, 1745; and governor of Carlisle 1752. After General Braddock's defeat Stanwix was sent to America in command of a battalion of the Royal Americans, and in 1758 was made brigadier and sent up the Hudson to the Oneida portage, where he built Fort Stanwix. In 1759 while Wolfe was storming Quebec, he was in command in Pennsylvania, rebuilt Fort Duquesne, was promoted to major-general, and returned to England in 1760. He was made lieutenant-general in 1761 and governor of the Isle of Wight in 1763.

Stanwood, stăn'wŭd, **Edward,** American editor and author: b. Augusta, Maine, 16 Sept. 1841. He was graduated from Bowdoin College in 1861 and was assistant editor of the Boston *Daily Advertiser* 1867–82 and editor 1882–3. He has been managing editor of the 'Youth's Companion' since 1884 and has published 'History of Presidential Elections'; (1884); 'History of the Presidency' (1898).

Digitized by Google

Digitized by Google

Digitized by Google

Stanza, a number of verses so connected with each other by metre and rhyme as to form one of the regular divisions of a poem. In Italian the word is used in a special sense to denote that form of stanza commonly called the *ottava rima*. The most celebrated stanza of English invention is the Spenserian.

Stape'lia, a genus of cactus-like plants of the order *Asclepiadaceæ*, about 80 species of which are natives of South Africa. They have angular, generally four-sided, leaflets, green stems and branches, covered with excrescences; bear large, showy, grotesquely mottled or barred flowers irregularly in angles and notches of the stems. Because of their fetid odor they are popularly known as carrion-flowers, a name shared by several other unrelated plants. The flowers are frequently disproportionate to the size of the plant; for example, *S. gigantea* produces flowers about a foot in diameter. Except in fanciers' collections and in botanic gardens these plants are rarely cultivated, probably because of their smell.

Staples, stā'plz, **Robert Ponsonby,** English artist: b. 30 June 1853. He received his instructions in art at the Louvain Academy of Fine Arts 1865–70; at Brussels under Portaels, and at Dresden (1867). In 1869 he visited Paris and exhibited at the Royal Academy, Burlington House, 1875. He subsequently passed a year in Australia (1879–80). He served as Art Master of the People's Palace, Mile-End Road (1897). His chief works are 'Guilty or Not Guilty'; 'The Last Shot for the Queen's Prize, Wimbledon'; 'Cardinal Manning's Last Reception'; 'Mr. Gladstone introducing the Home Rule Bill'; 'The Queen and King Edward VII.'), etc.

Star-anise, the fruit of a shrub or small tree from Eastern Asia (*Illicium anisatum*), of the Magnolia family. It has small, but beautiful, fragrant blossoms, in terminal cymes and oblong leaves, which emit when bruised, the odor of anise. The fruit is a brown capsule, like a star, commonly eight pointed, each ray being a follicle, opening at the top, and enclosing an oval, glossy brown seed. These seeds yield an aromatic oil, which is carminative and stimulative, and although sometimes used therapeutically, is chiefly employed for flavoring foods and liqueurs, having a sweet taste and odor more like fennel than anise. The fruits are burned as incense in the temples of Japan, where the tree is a great favorite with the native gardeners. It is also cultivated in Florida.

Star-apple, the fruit of *Chrysophyllum cainito*, a saponaceous tropical tree, native to the West Indies. It is about 25 feet high, very ornamental, and has slender branches and very beautiful foliage, the leaves being clothed beneath with golden-yellow hairs. The fruits are berries, about the size and shape of an apple, and vari-colored, white, green, yellow, rose-colored, or purple; it contains a pulp with a pleasant flavor, but unless perfectly ripe is astringent and leaves an intense acridity in the mouth which is difficult to remove. In the centre are eight or ten cells, each containing a shining brown seed. When cut across, while immature, these cells form a many pointed star in the centre of the fruit.

Star of Bethlehem, stated in the New Testament to have appeared in the sky at the time of the birth of Christ. At various times since the appearance of Tycho Brahe's star in the constellation Cassiopeia in 1572, the celebrated Nova of that year, it has been suggested that this might be a variable star of long period, though there is nothing now in the vicinity of the place of this star brighter than the 12th or 13th magnitude. Nevertheless, a reported appearance of a bright star in somewhere near that part of the heavens about the middle of the 13th century combined with a more vague account of some similar appearance a little more than 300 years earlier, furnished material for conjecture that these might possibly be former appearances of the star of 1572, giving a period of about 310 or 315 years, which would carry it back three periods more to about the time of the birth of Christ. The efforts of astronomy in this case to convert into a plain scientific fact an event miraculously connected with the birth of Christ and Christianity, have so far proved unsuccessful.

Star of Bethlehem, a liliaceous herb of the genus *Ornithogalum*, the flowers of which are fancied to resemble the star which located the place of Jesus' birth. The species are natives of the old world, but two have escaped from gardens and become naturalized in America, especially *O. umbellatum*. It is low, with narrow leaves (the midrib being lighter in tone), which spring from a coated bulb, the flowers are arranged in the plan of threes, and are corymbose and borne on slender, bracted scapes in late spring. The 6 perianth-segments are nearly equal and separate, and open only in sunshine, the outside of each being pale green with white edges, while the inside of all is pure white. The small bulbs have been eaten in Palestine. Among other species of *Ornithogalum*, is the *O. caudatum* from the Cape of Good Hope, sometimes called onion-lily. Its leaves dry into long tails and its watery bulbs have great vitality unless exposed to severe cold. The satin-flower is the hardy *O. nutans*, with nodding green, white-lined blossoms, and, like *O. narbonense*, remarkable for its height (three feet), is a hardy garden bulb.

Star of Bokhara, Order of. See ORDERS, ROYAL.

Star-chamber, formerly an English court of civil and criminal jurisdiction at Westminster. It consisted originally of a committee of the privy-council and was remodeled during the reign of Henry VII., when it consisted of four high officers of state, with power to add to their number a bishop and a temporal lord of the council, and two justices of the courts of Westminster. It had jurisdiction of forgery, perjury, riots, maintenance, fraud, libel, and conspiracy, and could inflict any punishment short of death. Its process was summary and often iniquitous (especially in the reigns of James I. and Charles I.), and the punishment it inflicted often arbitrary and cruel. This court was abolished in 1640. In the modern usage of the term a star-chamber is any secret session of a legislative body, council, board or other organization. In the United States Senate a star-chamber session is called an executive session.

Star-grass, a name given to several kinds of plants that have star-shaped flowers. Among the ones most widely known in America is the *Hypoxis hirsuta*, a small herb belonging to the Amaryllis family, with a corm or short root-

Digitized by Google

stock, grass-like leaves springing from it, and a slender hairy scape, bearing several stellate 3-merous flowers. These are bright yellow, and there are six narrow segments of the perianth, hairy on the outside, and widely spread. One of the lily tribe is the *Aletris farinosa,* a perennial herb; with tuberous rhizomes and bitter fibrous roots, which have been used as a domestic remedy, for intermittent fevers and for colic; whence its other name "colic root." It is often found in sandy soil, its smooth, lanceolate leaves lying on the ground in a flat rosette, from which arises a tall, stiff stem, terete, and sometimes three feet high, with narrow bract-like leaves. It is crowned by a virgate, spike-like raceme of bell-shaped white flowers, just touched with yellow, and having an appearance of crinkliness like crêpe, and as if covered with a rough powder externally. The water star-grass, is an aquatic plant (*Heteranthera dubia*) of the pickerel-weed family, its slender forked stems, and grassy floating leaves being found in still water. The flowers are arranged on the plan of threes, and their primrose-colored, stellate rays are widely separated, narrow, and acute.

Star of India, Order of. See ORDERS, ROYAL.

Star of the Ocean, Order of. See ORDERS, ROYAL — *Hawaii.*

Star Quartz, a variety of vitreous quartz, containing thin layers of a foreign substance, which produce the phenomenon of asterism in transverse sections of a crystal when cut en cabochon. Good material of this character has been found in Canada.

Star Routes. See POST AND POSTAGE; POSTAL SERVICE IN COMMERCE.

Star of Rumania, Order of. See ORDERS, ROYAL.

Star Sapphire, a variety of the mineral corundum which exhibits a six-rayed star in transverse sections of a crystal when cut en cabochon. This "asterism" appears to be due to reflections from the surfaces of twinning lamellæ. Fine star sapphires come from Ceylon and are prized as gems. Star Ruby is the ruby-red asteriated sapphire.

Star Spangled Banner. See NATIONAL HYMNS.

Star-thistle, one of the European plants of the genus *Centaurea* (q.v.). They are not true thistles, but are closely allied composites. *C. calcitrapa,* is an annual, much branched and spreading weed sparingly naturalized in America. It has 1 to 2 pinnatifid, serrulate, spiny leaves, the upper one sessile and clasping. The flower-heads are purple, small and rayless, and have an ovoid receptacle surrounded by ovate, involucral bracts, the outer being long and spreading, and tipped with stout spines. The common name is said to be derived from a fancied resemblance of the spiny involucre of the yellow flowered star-thistle (*C. solstitiatis*), to the weapon called "morning-star," an iron ball beset with short spikes.

Star of the West. At sunset 5 Jan. 1861, the merchant steam-vessel Star of the West sailed from New York to supply and reinforce Major Robert Anderson, at Fort Sumter, Charleston harbor. She was commanded by Capt. John McGowan, was unarmed, and carried a large quantity of supplies for Anderson, as well as Lieut. C. R. Woods, United States army, with four officers and 200 artillery recruits. She reached the outer bar of Charleston harbor before daylight 9 January, and as the harbor lights were out, put out her own and groped in the dark until nearly daylight, when, guided by the light on Fort Sumter, she stood in. The South Carolina authorities had been notified of her coming by Secretary Thompson of President Buchanan's cabinet, and a vessel was lying off the main channel watching for her, and when she was seen gave signal-lights of warning to the Confederates on Morris Island, and then ran up the harbor, the Star of the West following, as soon as it was light, and steaming up the main channel for Fort Sumter. She flew the United States ensign at the fore, and went on without interruption until within 1¾ miles of Forts Sumter and Moultrie, when she was fired upon by a battery near the north end of Morris Island and about ⅝ mile distant. She ran up a garrison flag, to which no attention was paid, save to increase the rapidity of the Confederate fire, which was kept up on her from Morris Island, with an occasional shot from Fort Moultrie. McGowan was powerless to defend himself, and no assistance came from the guns of Fort Sumter, as Major Anderson had not been notified of this expedition for his relief. Therefore McGowan turned his vessel seaward, after 17 shots had been fired at it, two of which had struck it, and returned to New York on 12 January. This firing on the flag of the United States was the first overt act in the Civil War. At the South there was great exultation that the flag of the Union had been insulted; at the North it produced but little excitement. Consult 'Official Records,' Vol. I.

E. A. CARMAN.

Starch, a proximate principle of the vegetable kingdom, is a white substance found in almost every plant at some period of its life-history, and is especially abundant in wheat, potatoes, arrowroot and other similar kinds of vegetation. It occurs in the albumen of the seeds; in the cotyledons of the embryo, in the pith, the bulbs, stems, etc. Starch appears to be formed in plants in greatest quantity when there is a large supply of nutriment, and it disappears when the nutriment becomes deficient. The amount of starch in various alimentary substances is exhibited in the following table:

Name of Substance.	Starch in 100 Parts.
Haricot-bean flour	99.96
Wheat-flour	57 to 67
Rye-flour	54 to 61
Oats	30 to 40
Barley-flour	64
Barley	38 to 42
Indian corn	65 to 66
Corn-starch	77 to 78
Potatoes (air-dried)	16 to 23

Starch is a soft white shining powder; under the microscope it is seen to consist of a number of granules, each of which is formed of a series of envelopes concentrically arranged round a common nucleus. Inasmuch as these layers or envelopes are of variable thickness they cause the granule to assume more or less an ovoid form. Starch dried at ordinary temperatures always retains an amount of water varying from 12 to 18 per cent; but by drying in a vacuum at

Digitized by Google

100° it may be obtained perfectly free from water. It is insoluble in cold water, alcohol, and ether; but if it be boiled with water the starch granules are swollen and broken up, so that on cooling, a stiff, gelatinous mass, starch-paste, is produced; on largely diluting this paste with water, the swollen granules for the most part subside, but a considerable quantity of starch remains in solution. By boiling starch mixed with a quantity of water, under pressure, at a temperature of about 150°, it is mostly dissolved, and on filtering the liquid and allowing it to cool small granules of starch are deposited, which are slightly soluble in cold water, and are at once dissolved by water heated to 70° C. This modification of starch is known as soluble starch. Starch may be detected by boiling with water, cooling, and adding tincture of iodine, when a fine deep blue color is produced; this color is destroyed by heat, or by substances such as alcohol, ether, etc., which dissolve and so remove the iodine.

Nitric acid acts on starch in different ways, according to the strength of the acid used and the temperature. Cold concentrated nitric acid forms a substitution product, in which one hydrogen atom of the starch is replaced by the group NO_2. A mixture of concentrated nitric and sulphuric acids gives rise to the formation of a dinitro-substitution product, in which two atoms of hydrogen are replaced by the group NO_2 twice. From these and other facts the formula $C_6H_{10}O_5$ is deduced for starch. Hot nitric acid converts starch into oxalic, malic, and acetic acids.

Preparation of Starch.— With regard to the purposes to which starch is applied, the various kinds may be divided into (1) starches used for food and (2) starches used for laundry and other industrial purposes, though certain kinds are extensively used under both of these heads. In their chemical relations all varieties of starch are identical, but in their physical constitution and microscopic structure they present marked differences, and they also vary much as regards digestibility and suitableness as articles of food. Seen under the microscope, the various kinds of starch present the appearance of minute granules made up of a series of layers concentrically surrounding one or sometimes more nuclei. The size of these granules and the arrangement of layers differ in every different species of plant, and therefore the source of any particular starch is readily determined by microscopic examination.

The food starches embrace arrowroot, tous-les-mois, sago, and tapioca. Corn-starch, which has an enormous sale, is simply the starch of Indian corn or maize separated from the grain by prolonged steeping in water, crushing the swelled grains between cylinders under a flow of water, and washing the mass through a cylindrical sieve so as to separate out the husky matter. The milk-like fluid which contains the starch in suspension is run along a series of gently inclined surfaces, on which the heavier granules are deposited, the lighter and finer particles being carried with nitrogenous matter into settling-tanks. The deposit which accumulates in the settling-tank is purified by repeated straining and settling, and the separated starch is dried by gentle artificial heat, when it crumbles to a powder, and as such it is packed up for use.

Starch for industrial purposes is chiefly obtained from potatoes, wheat, and rice, but sago starch is also extensively employed for other than food purposes, and starch from many different substances finds occasional or limited employment. Potatoes affected by disease yield as pure and useful a starch as sound tubers. On a small scale the preparation of starch from potatoes is a simple operation. The tubers have simply to be thoroughly steeped and washed to free them from all earthy impurity, then rasped down to a fine pulp in a tub of water and allowed to settle, when the starch will fall to the bottom and the greater part of the skin or husk will float on the water. By repeated washing and settling of the starchy deposit the starch may be obtained in a condition of purity, and it may then be dried by gentle heat for preservation and use. On the manufacturing scale, machinery of various kinds is adapted for performing the several processes of steeping and washing, straining out of stones, rasping, straining, settling, purifying, draining, and drying which the potatoes undergo. Beyond its use in industrial pursuits in common with other starches, potato-starch is much employed for making imitation sago, for adulterating and as a substitute for the more costly food-starches, for preparing starch-sugar, and as a source of potato-spirit.

Wheat-starch is prepared by two distinct processes. By the first and old method the grain is subjected to a process of fermentation whereby the gluten or nitrogenous constituent of the wheat is rendered soluble and the remainder of it loses its adhesive property, and in this condition the starch is easily separated out by a washing wheel or drum. By this process the greater part of the gluten is wasted, and a smaller yield of starch is obtained than can be secured by the more recent system of Martin. The principle on which it proceeds can be easily illustrated by making a dough of flour, placing it in a muslin bag, and squeezing it under the water, when the starch exudes mingling with the water and settling as a sediment, leaving within the muslin a gray semi-elastic mass consisting chiefly of gluten. In this way the gluten is saved, and can be utilized for cattle-feeding, etc. By whatever process prepared, wheaten starch is purified by repeated washing and settling, and dried by gentle heat, and on drying it assumes the columnar structure by which it is familiarly known.

In the preparation of rice-starch, a variety preferred for laundry puposes, the grain has to be steeped in a slightly alkaline solution on account of its peculiarly hard and horny structure. In addition to being most extensively used in laundries, starch is largely consumed in the manufacture of dextrin (q.v.), and it is also employed as a thickener in calico-printing, and in the finishing of bleached and printed calicoes. A paste of starch is generally used by photographers for mounting prints, and it finds a valuable minor adaptation in dusting molds in metal-casting, besides being applied for many miscellaneous purposes.

Statistics.— In the United States in 1900 there were 124 starch factories having an invested capital of $11,671,567. There were 2,655

Digitized by Google

persons employed and the total value of the product for the year was $9,232,984. In this production New York ranked first, Indiana second and Ohio third. The total quantity of starch manufactured was 297,803,139 pounds. Of this total, 247,051,744 pounds were made from Indian corn, and 50,751,395 pounds from all other materials. The average value per pound of Indian corn starch was 2.5 cents, and the average value of all other starches was 3.8 cents per pound.

Starfish, any echinoderm of the group *Asteroidea* (see ECHINODERMATA), in which a pentagonal disk forms the central body, whence radiate five or more pointed arms, containing prolongations of the stomach, as well as digestive glands, reproductive organs, etc. The mouth is on the inferior surface of the disk, and the vent (when one exists) is on the upper surface. The exoskeleton consists of a mosaic of limy plates united and covered by a leathery, usually reddish-brown skin, forming a pliant armor. The plates of the disk are similar to those of the «cup» of crinoids (q.v.) and similar echinoderms. Those of the arms form along the floor a groove carrying the ambulacral water-vessels and tube-feet. The exterior of the plates, except in the ambulacral grooves, is studded with tubercles, each bearing a spine, giving the starfish a generally spiny appearance. Studding the skin among the spines are numerous branchial papillæ and the usually three-jawed, flexible-stalked pedicellariæ, which continually bend about and by their snapping pick up and remove accumulated waste matter from the respiratory surface of the animal. So independently do they act that for many years they were considered to be parasites. The alimentary canal is simple with a pair of large cæcal digestive glands reaching into each arm. The nervous, blood, and water-vascular systems conform to the plan described in the article ECHINODERMATA. Distinct eye-spots are present at the tips of the rays in most species, the large orange-colored spot which is popularly called the «eye» of the starfish being in reality the madreporic plate, by means of which water is admitted to the ambulacral system. In starfishes the sexes are usually separated and the eggs fertilized in the water. Development takes place with a metamorphosis, the larval stage being free-swimming, provided with ciliated bands and processes, and known as the bipinnaria. The body of the young starfish forms within the body of the larva, only a small portion of which develops directly into the starfish, the remainder being simply absorbed to nourish it.

Locomotion is accomplished by means of the thousands of tube-feet arranged in double rows on the under side of each arm. These successively extend, attach themselves, contract, let go, and reach forward again, hundreds acting together to draw the body slowly but continuously onward. The individual feet are extended by means of water forced into them by the contraction of the ampullæ, with which each is provided, and contracted by their own musculature, which forces the water back into the now relaxed ampulla, the supply of water in any part being regulated through the madreporic plate and the system of canals and polian vesicles. Besides the sexual mode of reproduction starfishes possess the power of regenerating lost parts developed to so great a degree that it amounts to asexual reproduction. When handled or injured they will often deliberately, or, more properly speaking, automatically, cast off an arm or even all of the arms close to the base. Not only will the disk regenerate any number or all of its arms when lost, but in some cases the single arms will develop new disks, thus producing several individuals from one. Experimental cuttings of starfishes has shown how bifurcated or extra arms may be produced. As their only natural enemies are bottom feeding fishes of the cod family and as it seems probable that one or more arms could thus often escape capture, this capacity for regeneration, combined with their tenacity of life and enormous fecundity, probably accounts for the surpassing numbers in which they sometimes occur.

All starfishes are marine, and most of them live in comparatively shallow water, though a few extend to great and many to moderate depths. As fossils they occur in most formations from the Cambrian upward, but are much less numerous than the sea-urchins, being less well adapted by their structure for preservation. While the number of arms is generally five or some multiple of five, some genera bear irregular numbers as 13 in *Solaster*, 9 to 13 in *Brisinga*, or upwards of 20 in *Heliaster*, while a few, as *Culcita* and *Asteriscus*, are pentagonal and nearly without trace of arms.

Starfishes are voracious creatures which feed for the most part upon mollusks, including such large bivalves as oysters. The manner in which they accomplish this apparently impossible feat is very remarkable. By means of the suckers at the ends of the tube-feet the starfish attaches part of its arms to each valve of the oyster and by a steady continuous traction sooner or later so weakens the adductor muscle of the latter that the valves gape open. As the mouth is too small to admit the body of the oyster the stomach is protruded and, enwrapping its prey, the soft body is gradually sucked through the mouth. Small gastropods may be taken into the mouth entire. Many species of starfishes live on the bottom in vast shoals and, although sluggish creatures, they often migrate to new feeding grounds, moving over the ground steadily in a definite direction.

The best-known starfishes of our Atlantic shores are the *Asteracanthion vulgaris* and *A. forbesii*, the former chiefly north, the latter south of Cape Cod, though both are found in Vineyard Sound and the neighboring waters. They are nearly alike, reach a diameter of 12 or 15 inches and extend from low water to considerable depths. Both species congregate in great numbers on mussel and oyster beds, often committing great havoc on the latter. They are removed from the latter by the boat load by means of dredges and tangles and cast ashore. Formerly the oystermen broke them into pieces, which were cast into the water in expectation of killing them, with the result that their numbers were increased greatly. The smooth starfish (*Cribrella sanguinolenta*) is a very pretty small shallow water species with five long, round, nearly smooth arms and a color which varies from purple to yellow and pink. It is most

Digitized by Google

MAJOR GENERAL JOHN STARK.

From the portrait made by U. D. Tenney, by order of the New Hampshire Legislature, A. D. 1810.

Digitized by Google

Digitized by Google

abundant north of Cape Cod and is remarkable in utilizing the sides of the mouth as a brood pouch in which the young are carried. *Echinaster sentus* is a related southern species with rough spinous arms. *Croosaster pappossus* is common in a few fathoms of water on the New England coast. It has a very broad body disk and flattish arms, which vary from 12 to 15 in number. *Luidia clathrata* and *Astropecten articularis* are flat, very brittle, five-rayed starfishes with the upper surface very densely covered with small spines and the arms margined with large plates and a fringe of spines. Both occur on the South Atlantic coasts, occasionally as far north as New Jersey. Many interesting species are dredged in deeper water or are sometimes thrown ashore during storms, and others occur in the Gulf of Mexico in shallow as well as deep water. One of these is the massive, heavily-armored, rigid *Pentaceros reticularis,* the species commonly sold in shell shops at the seaside resorts, and the largest starfish of the Atlantic coast. The Pacific coast fauna is much richer and more varied, among the species being the gigantic *Asterias giganteus,* over two feet in diameter and six-rayed, the ten-rayed *Solaster decemradiata,* the flat, granulated, bright-red *Mediaster æqualis,* the thick, flat, pentagonal, great-spined *Nidorella armata,* and the nearly armless and very small *Asterina miniata.*

Consult: Agassiz, ‹North American Starfishes,› Memoirs Mus. Comp. Zool. (Cambridge, 1877); Sladen, ‹Asteroidea of the Challenger Expedition› (London, 1889); Lankester, ‹Treatise on Zoology,› Pt. III. (London, 1900); Lockington, ‹Standard Natural History,› Vol. I. Boston, 1884).

J. Percy Moore,
University of Pennsylvania.

Stargard, stär'gärt, Germany, Prussia, in Pomerania, lies 21 miles southeast of Stettin, on the Ihna River. It consists of three parts, the main town and two suburbs. It was formerly a fortified town; of the ancient walls only the gates remain, the rest having been replaced by promenades. There is a monument commemorating the Franco-Prussian War. The buildings deserving notice are the old town-house, churches, gymnasium, and orphan asylum. It has a law-court and government offices. There is a brisk trade in agricultural produce; the manufacturing industry comprises iron foundries, machine-shops, soap and oil factories, distilleries, roofing, etc.

Stark, John, American officer: b. Londonderry, N. H., 28 Aug. 1728; d. Manchester, N. H., 8 May 1822. In 1755 he became a lieutenant in Major Rogers' rangers and fought through the French and Indian struggle around Lake George and Champlain. In 1775 he joined the Continental army, was appointed colonel, and fought at Bunker Hill and later at Princeton and Trenton. After the retreat of Gen. St. Clair and the capture of Ticonderoga by the British, Stark was put in command of a force of «Green Mountain boys,» that met and defeated an English detachment under Baum at Bennington 16 Aug. 1777. A supporting British force under Breymann was also defeated. These events paralyzed the British operations and led to the surrender of Burgoyne at Saratoga. He was promoted brigadier-general, and continued in active service until the end of the war.

Starkey, stär'kĭ, **Thomas Alfred,** American Protestant Episcopal bishop: b. Philadelphia, Pa., 1819; d. East Orange, N. J., 17 May 1903. He was educated as a civil engineer and engaged in that profession in 1839–45 after which he studied theology and in 1848 he was ordained to the priesthood. He was rector of Christ Church, Troy, N. Y., in 1850–4, of Saint Paul's, Albany, N. Y., in 1854–8, of Trinity Church, Cleveland, Ohio, in 1858–69 and was in charge of the Church of the Epiphany, Washington, D. C., in 1869–72. He was called to Saint Paul's Church, Paterson, N. J., in 1877 and in 1880 he was consecrated bishop of northern New Jersey. The name of the diocese was changed to Newark in 1886, and at about that time the bishop removed to East Orange.

Starling, a field-bird of the family *Sturnidæ,* known by the compressed sharp bill, the long and pointed wings, and the short tail. The tarsi are stout, and covered in front with broad scales. The toes are also elongated and strong, the hinder toe being largely developed. The common starling (*Sturnus vulgaris*) is a well-known European bird, commonly seen in large flocks, particularly in marshy districts. The general color is dark green, tinted with purple hues, and with metallic lustres. The shoulders are brown or buff, the wing-coverts edged with pale brown, and the general plumage spotted with buff. The breast feathers are elongated and pointed; the beak is yellow. In the second year of life the characteristic colors consist of the adult colors just described, these, however, being of generally lighter hue, whilst the general surface is marked with light-colored spots. The first year's birds are brown. The females are less brilliantly colored than the males. The nest is loosely constructed, and is generally found in some ruined wall or castle, or in a hollow tree. The five eggs are pale blue. The young are tended by both parents, and when full grown aid in swelling the numbers of the large flocks. The food consists of insects, and these birds haunt domestic animals to get the insects that prey upon them. They often perch on the backs of cattle in search of the insect larvæ that burrow in the skin; and pluck wool from sheep for the purpose of lining the nest. Mollusks, worms, and vegetable matters are also eaten; and these birds have been known to strip whole shrubberies of their leaves. The common starling occurs throughout Europe, Africa, and most of Asia, and is migratory. They are viewed with great favor in many districts, are caught to be kept in cages, and may be taught to speak, to mimic sounds with great distinctness, and to whistle tunes. Their natural note is a peculiar, indrawn, clear and pleasing whistle. They have been acclimatized in the neighborhood of New York, and are likely to spread in the United States. Various more or less similar or related birds are called starlings in India and Australia. Consult, Newton, ‹Dictionary of Birds› (New York 1896).

Starnina, Gherardo, gā-rär'dō stär-nē'nä, Italian painter: b. Florence 1354; d. 1407. He was a pupil of Antonio Veneziano. After painting the history of Saint Nicholas and Saint Anthony, on the ceiling of the Casteilani chapel in Santa Croce, he was forced for political reasons to take refuge in Spain. Here he worked for the king and others, returning to Italy with

Digitized by Google

considerable wealth (1387). He made many frescoes but nothing remains save the 'Death of Saint Jerome' in Santa Maria del Carmine.

Starnosed Mole. See MOLE.

Starovertz. See RELIGIOUS SECTS.

Starr, stär, **Frederick,** American anthropologist: b. Auburn, N. Y., 2 Sept. 1858. He was graduated from Lafayette College in 1882 and from 1889–91 was in charge of the department of anthropology at the American Museum of Natural History. Later he made extensive travels in Mexico making special studies in anthropology and ethnography. He is editor of the 'Anthropological Series,' and has published 'Some First Steps in Human Progress' (1895); 'American Indians' (1899); 'Indians of Southern Mexico' (1899); 'Strange People' (1900); etc.

Starr, Moses Allen, American neurologist: b. Brooklyn, N. Y., 16 May 1854. He was graduated from Princeton University in 1876 and received his medical degree from Columbia University in 1880. He is editor of the 'Psychological Review and Journal of Nervous and Mental Diseases,' and has published 'Familiar Forms of Nervous Disease' (1893); 'Brain Surgery' (1895); 'Atlas of Nerve Cells' (1897), and lectures on 'Diseases of the Mind' (1898); and 'Diseases of the Nervous System' (1899).

Starry Cross, Order of. See ORDERS, ROYAL.

Stars, a designation familiarly applied to all the heavenly bodies which look like points of light. This designation includes four of the planets, Mars, Venus, Jupiter and Saturn. In scientific language the term is applied only to those bodies which seem fixed on the celestial sphere, and are therefore termed *fixed stars.* These are immense incandescent bodies, scattered through the immensities of space at distances which beggar all our conceptions. In accordance with the general plan of the present work, we begin with a study of the stars as they appear to us, and then pass to the consideration of their actual constitution and situation in space. We shall therefore suppose the reader to scan the heavens at night while we point out certain features of the scene of grandeur then presented to his vision.

The first feature to be noticed is the great diversity in the brightness of the stars, or, to use a technical expression, in their *magnitudes.* These range all the way from that of the brightest stars down to the point of invisibility to the naked eye. The smallest telescope will show scores of stars too faint to be seen without its aid, and the greater the power of the instrument, the greater the number that will be brought into view, without any limit yet known.

The ancient astronomers divided the stars into six orders of magnitude, called the first, second, etc. The 15 or 20 brighter stars were classified as of the first magnitude, those a grade below them as of the second, and so on, until they came to the sixth, which comprised the faintest stars visible to the unaided eye. All these stars are now called *lucid;* fainter ones *telescopic.* In modern times the preceding system of magnitudes has not only been extended to the telescopic stars, but has been arranged on a plan which gives greater precision, and enables us to designate the exact measure of the light which we receive from a star by its magnitude. The magnitudes of stars are now designated to tenths, or, to give greater precision, even to hundredths of a magnitude. Thus we have stars of magnitudes 3.0, 3.1, 3.2, etc. These numbers are arranged on a diminishing scale of light, so that a difference of one magnitude corresponds to the multiplication or division of light by a number very near 2.5, or, more exactly, the number whose logarithm is 0.4. This means that a star of magnitude 3.0 is about two and a half times as bright as one of magnitude 4.0; this again about two and a half times as bright as one of magnitude 5.0, etc. The exact scale is such that a star of the first magnitude is precisely 100 times as bright as one of the sixth, while the latter is 100 times as bright as one of the eleventh, so that an increase of five units in the scale of magnitude corresponds to a division of the light by 100.

Careful examination will also show that the stars of each magnitude are several times as numerous as those of the brighter magnitudes. There are three or four times as many stars of the fourth magnitude as of the third; three or four times as many of the fifth as of the fourth and so on in nearly geometrical progression. But when we pass to the stars invisible to the naked eye, the progression is not so rapid. Yet its common ratio does not fall below 2 at any point yet known. The result is that the stars of the fainter magnitudes are to be counted by millions. The faintest stars visible in the largest telescopes are about of magnitude 16 or 17.

Another familiar feature of the sky is that the stars are not scattered uniformly, but that the brighter ones appear to be collected to a greater or less extent into constellations. There is, however, no precise dividing line between one constellation and another. The irregularity is such that the number of constellations is somewhat arbitrary. The fainter the stars the less marked is the division into constellations. The telescopic stars cannot be divided into constellations at all. See CONSTELLATIONS.

Careful observation shows that the stars differ slightly in color. It is true that the colors are less marked than those of natural objects, there being no such red as the ruby, and no such bright green as the emerald among the stars. But there is a regular gradation from a yellowish red through white, to a well-marked, bluish tint. These differences of color are supposed to indicate different degrees of temperature of the stars, or different periods in their growth and development.

Number of Stars.— The whole number of stars in the heavens, visible to the naked eye, is about 5,000. As one-half of these are necessarily below the horizon at any one time, it follows that not more than 2,500 can be seen at once. But this is greater than the actual number visible under ordinary conditions, because small stars near the horizon are rendered dim or invisible by the thickness of the air through which we see them. Practically, it is not likely that more than 2,000 stars can ever be seen at once by the best eye, unless at elevated points where the air is very clear down to the horizon.

Up to the present time it has been impossible to make anything like an enumeration of the telescopic stars, because, as we have already said, every increase in the power of the telescope

Digitized by Google

brings out new stars so faint that they were before invisible. There is, however, no doubt that the stars visible in a large telescope are to be counted by tens of millions. It is now found that stars can be photographed with a large telescope which are so small that the eye would not perceive them in the telescope itself. It is probable that the whole number found on the best photographic plates amounts to more than 100 millions. But we must not suppose that this number would actually comprise all the stars in the sky. We do not know how many yet fainter stars there may be for every one that can be photographed.

The Milky Way.— Another feature of the sky connected with the stars is the Milky Way or Galaxy. This really stupendous though not striking object can be seen at some hour of any night in the year, its position in the sky depending on the season. In our latitudes it is quite near, or partly below the horizon during the evenings of May, and is then not readily seen, but even then it may be seen later in the evening. At the proper time, on any night, it passes nearly through the zenith, spanning the heavens like a complete arch, resting on two opposite points of the horizon.

Galileo, pointing his first telescope to the sky, found that this object was composed of congeries of stars too faint to be separately visible. This fact has been abundantly proved by modern observations. A very little study of the sky without a telescope will show that the milky light of these stars is by no means uniform, but is frequently gathered into bunches. These show that the Milky Way is in part made up of vast groups or collections of stars, rather irregular in form. The aspect of the Milky Way is also very different in different parts of its course. One of its most remarkable features is best seen in summer and autumn. It will then be noticed that, in the region of the zenith, the Milky Way seems to be divided into two separate streams with a comparatively dark space between them. This seeming cleft extends toward the south, nearly to the celestial equator, where one of the streams branches off toward the west and comes to an end, while the other continues on its course. It will also be noticed that at some points of its course the Galaxy is narrow and well defined, while in others, notably in the extreme south, it is wide and diffuse.

Many astronomers have occupied themselves in making photographs of various portions of the Milky Way. Barnard has used a large camera for this purpose, and, in several observatories, the largest telescopes have been so employed. One curious feature is brought out by these photographs. In that part of the Milky Way which in autumn is seen between the celestial equator and the southern horizon, numerous clefts and vacant spaces occur, as though there were actual openings through the mass of stars. This fact seems to show that the thickness of the Milky Way, or the distance through which the line of sight extends when we look at it, is less here than elsewhere. Going farther south, into regions invisible in our northern latitudes, other vacant spaces are found, known as *coal-sacks*. But it is found that stars really exist in these spaces, though they are comparatively few and faint.

Another feature of the southern hemisphere comprises two patches of light called the Magellanic Clouds. These are situated at some distance from the Milky Way, and yet seem to be of the same general nature as the latter. They may be described as two outlying collections of very faint stars.

It is found by careful observation and count, that the stars of any magnitude seem to be rather thicker in the region of the Galaxy than elsewhere. The smaller the stars the greater the thickness in and near the Galaxy becomes, so that it is probable that a large majority of the very faint stars belong to the Milky Way. Several other peculiarities connected with stars of the Milky Way will be better understood after we have described certain varying characteristics of the stars.

Naming the Stars.— Most of the brighter stars, not only those of the first and second magnitude, but a few remarkable ones of fainter magnitudes, had special names assigned to them in ancient and mediæval times. The oldest and best known of all these names is Arcturus, which is found in the book of Job. The names of Castor and Pollux were also assigned in classic antiquity to the two brightest stars in the constellation Gemini, or the Twins. But most of these special names are derived from designations given by the Arabs, which were supposed to express some peculiarity of the star. There are also quite modern names, *Polaris,* for example, which designates the Pole Star.

During the past three centuries most of these names have been, to a greater or less extent, replaced by a system of designating the brighter stars in all the constellations, which was introduced by Bayer about 1600. He assigned to the principal stars in each constellation the letters of the Greek alphabet, Alpha, Beta, Gamma, etc. Commonly the first letter of the alphabet is assigned to the brightest star, and the progress of the letters indicates, to a certain extent, the successive orders of brightness in the same constellation. But this rule was not uniformly carried out; frequently the successive letters taken in alphabetical order, designate the stars which follow each other in position. For example, in the familiar constellation of the Great Bear, the first six letters of the alphabet are applied to the consecutive stars which make up the Dipper. The Greek alphabet not being sufficient for all the stars, letters of the Roman alphabet are used when the Greek one is exhausted. Flamstead, Astronomer Royal at Greenwich, two centuries ago, adopted the plan of numbering the stars in each constellation. Any such system, however, is imperfect, and, taken altogether, there is a lack of uniformity in the method of designating the stars, except the brighter ones. The following are a few of the brighter and best-known stars which have well-known names.

Individual name	Name on Bayer system
Alcyone	Eta Tauri
Aldebaran	Alpha Tauri
Algol	Beta Persei
Antares	Alpha Scorpii
Arcturus	Alpha Bootis
Bellatrix	Gamma Orionis
Betelguese	Alpha Orionis
Canopus	Alpha Argus (Carinæ)
Capella	Alpha Aurigæ
Castor	Beta Geminorum
Fomalhaut	Alpha Piscis Australis

Digitized by Google

Individual name	Name on Bayer system
Mira Ceti	Omicron Ceti
Mizar	Zeta Ursæ Majoris
Polaris	Alpha Ursæ Minoris
Pollux	Beta Geminorum
Procyon	Alpha Canis Minoris
Regulus	Alpha Leonis
Rigel	Beta Orionis
Sirius	Alpha Canis Majoris
Spica	Alpha Virginis
Vega	Alpha Lyræ

Spectra of the Stars.—When the spectroscope was invented and applied, one of the first uses made of it was to analyze the light coming from various stars in order to see in what respect they differed in their constitution. The result has been to show that, out of several thousand stars which have been examined in detail, it can hardly be said that any two are exactly alike. It is true, in the highest branch of science, that one star differeth from another star, not only in glory, but in the substance which makes it up, as well as in various other features. At the present time the spectra of the stars are best studied by means of photography. The general fact that lights can be photographed which are too faint to be visible to the eye is here applied with great success. When only eye methods were used, it was hardly possible to accurately define or measure the spectral lines given by any but the brightest stars, and even here the measures were so uncertain that few definite results were reached. But, by applying photography, the negative on which the spectrum is impressed can be placed under a measuring engine, and the settings made by means of a microscope with the highest degree of precision that admits of being reached.

At an early period of spectroscopic discovery, Secchi, the Roman astronomer, made an exact classification of the spectra of stars, which he connected with their respective colors. The bluish stars he designated as of the *first type;* those which were almost pure white or slightly yellowish were of the *second type,* while those approaching toward red were mostly of the *third type.* Speaking in a rough way, it would seem that these gradations correspond to the absorption of the light by atmospheres surrounding all the stars. The more dense and the deeper this atmosphere the more blue light it absorbs, and the more red the remaining light appears. It seems, therefore, to be a general rule that the redder stars have the densest and most absorbing atmosphere. From many such stars a large part of the blue and green light is cut off. This deficiency in the blue light may also be due, in some cases, to the stars which show it being not so hot as the others; because we know that the hotter an object the more blue light it radiates in proportion to its red light. But everything we know of the stars leads us to believe that these cases are exceptional.

A very remarkable fact in connection with this classification is that the blue or first type largely predominates in the stars of the Milky Way, while stars distant from the Milky Way mostly belong to the other two types. Quite possibly it may be found that this distinction will enable us to determine in what part of the universe a star is situated, by means of its spectrum. When, at Harvard Observatory, the spectra of the stars were photographed on a large scale, and the number studied brought up into the thousands, it was found that Secchi's classification was quite insufficient. We now have a great number of such classes designated by letters of the alphabet and numerals which are too technical to be set forth in the present article. We shall mention but a single type known as Orion stars, because many of the stars showing it belong to the constellation Orion. A remarkable peculiarity of this type is the great number of fine lines in the spectra, many of which do not belong to any known substance. What gives great interest to it is that the stars which show it belong mostly or entirely to the Milky Way, and have markedly slower proper motions than the stars in general.

One result of spectral analysis is that most of the stars are composed in the main of the same chemical elements which we know to exist upon the earth: iron, calcium, and hydrogen seem to be present throughout the whole universe of stars. It cannot yet be said with certainty to what extent elements unknown on the earth exist in the stars, for the reason that the spectrum of an element depends so much upon the conditions of pressure or temperature to which the substance is exposed. We may regard it as certain that, whether elements unknown to us do or do not exist in the stars, the substances which form the stars, and especially the nebulæ, exist in many cases, in a form different from any we have yet produced in the laboratory.

Proper Motions of the Stars.—One of the most remarkable features of the universe is that every so-called fixed star is moving forward on an undeviating path which, so far as we can yet determine, is a straight line. This is called the *proper motion* of the star. Nothing is better calculated to give us an idea of the extent of the universe than the contrast between the speeds of these motions, as we know that they really are and the apparent speeds as we observe them from the earth. The actual speed is enormous when compared with any that we can produce by artificial means. The speed of a shot from the most powerful gun that can be made can scarcely, if at all, exceed half a mile per second. But if the motion of any star is as slow as one mile a second, it is only in very rare and extraordinary cases. The average speed of the stars is about 20 miles a second; and this motion, it must be remembered, is not, so far as yet determined, motion round and round in an orbit, but a straight-ahead motion, never relaxing and never swerving. Almost every star, therefore, travels hundreds of millions of miles every year, century after century. And yet, so slow do the motions appear to us that the naked eye can see no change in the configuration of the constellations during a period of thousands of years. A remarkable instance of this kind is afforded by Arcturus, which is, so far as we know, one of the swiftest moving stars in the heavens. It seems quite certain that its speed exceeds a hundred miles a second, and it may be much greater than this. And yet, if Job could again come to life and study the constellation Bootis, in which Arcturus is situated, he would scarcely notice any change in its appearance. There is not a star in the constellation Orion moving so fast that any change would be noticed by the naked eye in 100,000 years. The result is that the motions in question have been detected only by the most refined observations of modern times, extended through long periods. Every star in the heavens appears in the same position when observed night

Digitized by Google

after night. There are very few in which the astronomer can detect any motion by one year of observations. Accurate determinations of position commenced with the observations of Bradley, astronomer royal of England, in the middle of the 18th century, who determined the position of more than 3,000 of the brighter stars. Since his time the position of several hundred thousand stars have been accurately fixed. Yet, so small is the apparent proper motion in most cases that it has actually been detected in the case of only a few thousand stars. Even now there are scarcely a hundred stars of which the motions are known to exceed one second in a year. To understand what this means we must reflect that it would take a good eye to see that two stars in the sky, 200 seconds apart, were not a single object. Had it not been for the great precision of telescopic determination, astronomers would not have known to this day that any star in the heavens had moved from the place which it occupied in the time of Ptolemy, nearly 1,800 years ago.

The following is a list of the stars whose proper motions exceed four seconds in a century. In the first column is given the name by which the star is commonly known; in the second and third its position; in the fourth its magnitude, and in the last its proper motion in a year:

Star	Position				
	R.	A.	Dec.	Mag.	Prop. Motion
	h	m	deg.		sec.
Cord. 32,416	0	0	— 37.8	8.5	6.07
O Eridani	4	11	— 7.8	4.5	4.06
Z. C. 5,243	5	7	— 45.0	8.5	8.70
Ll. 21,185	10	58	+ 44.3	7.3	4.76
Ll. 21,258	11	0	+ 44.0	8.7	4.41
Groomb. 1830 ...	11	47	+ 38.4	6.4	7.04
61 Cygni	21	2	+ 38.2	4.8	5.20
Epsilon Indi	21	56	+ 44.0	8.7	4.41
Lacaille 9,352 ...	22	59	— 36.4	7.1	7.00

It is very remarkable that only three of these stars are visible to the naked eye, and these three are below the fourth magnitude. It will be seen that the annual motion of the most rapidly moving star is less than 9" annually. If this star were to continue its course round the sky without ever stopping, it would take it more than 140,000 years to make the circuit of the heavens. Yet, its actual speed is known to be about 100 miles a second.

Proper Motion of the Sun.— Our sun being one of the stars, we may expect that it also has its own proper motion. But this motion cannot be directly observed. The only way in which we can detect it is by the relative motion of the other stars, just as we know that a railway train is carrying us along when we see houses and trees seeming to pass by us. The motion of the sun was detected by observing that, notwithstanding the varied directions in which the stars appear to us to be moving, there is an average tendency to move from a point in the constellation Lyra toward the opposite region of the heavens south of Sirius. These two opposite points are near the Milky Way, though not in it. From this general community of motion we infer that our sun, carrying the earth and all the bodies of the solar system with it, is moving toward the constellation Lyra. The point toward which the motion is directed is called the *solar apex*. It was formerly supposed to be situated in the constellation Hercules, but more recent investigations have placed it farther to the east. Its position is still uncertain by several degrees, and there is some difference of opinion among astronomers as to its exact location. But the best results seem to show its position, as defined by right ascension and declination to be about the following:

Right Ascension, 18 h. 40 m.
Declination, 33° north.

This point is about 6° south of the bright star Lyra. We may therefore say that our solar system is constantly journeying toward that region of the heavens where Lyra is situated.

Radial Motions of the Stars.— The most wonderful revelations of the spectroscope relate to the proper motions of the stars and lead to the measurement of the speed with which a star is moving to or from our system. This speed is called its *radial motion*. The possibility of determining it rests on the principle that the wave-length of light coming from a star is less when the star is approaching us and greater when the star is moving away from us. Hence, if, on measuring the refraction of a particular ray emitted by a star, we find it to be greater than its regular value, we know that the star is receding from us, and, in the contrary case, that it is approaching us. This branch of observation is so new that the radial motions of only a few hundred stars have yet been determined. But their measurement is being carried on at the Lick and some other observatories with great vigor; and before many years have passed we may hope to know the radial motions of most of the stars visible to the naked eye.

It is very interesting that these measures agree as nearly as we could expect with observations on the position of the stars as to the direction in which our solar system is moving. Moreover, they have enabled Campbell to determine with an approximation to certainty the speed of the motion, which is about 11 miles per second. The whole solar system, and our earth with it, has therefore been pursuing a journey through space during the whole of human history, nay for hundreds of thousands, possibly for millions of years. Even with this rapid and continuous motion it will probably take us half a million of years to reach the region in which Vega, the brightest star in the constellation Lyra, is now situated.

The proper motions of the stars naturally suggest the idea that these objects all have their proper orbits and are performing revolutions round some centre as the planets do around the sun. The idea of a universe of which this might be true — of a system in which the years were counted by millions of our years is very captivating. But truth compels us to say that up to the present time astronomical science furnishes no sound basis for the reality of such a system. Every star seems to be pursuing its own headlong course without any reference to the existance of the other stars. If their motions belonged to a system there would be some regularity — stars in the same regions of the heavens would move with something like the same speed. But no resemblance of this sort can be traced.

Digitized by Google

Moreover the general trend of science is toward the conclusion that the duration of the universe, though very long, is finite and is not sufficient to enable a star to have made many revolutions round any centre.

Double Stars.— A careful watcher of the heavens will notice that there are several pairs of stars in the heavens — two such objects being so close together as to suggest that they must have some connection. The most striking case of this sort is in the Hyades, a V-shaped figure having the bright red star Aldebaran at one end of the «V.» In the middle of one of the lines of the «V» are two stars of the third or fourth magnitude, forming a very beautiful pair. This pair is easily to be seen, in some part of the sky on any clear evening in autumn or winter. Another case of the same sort is that of one of the brightest stars in the constellation Capricornus, visible in summer and autumn, which has a much fainter star alongside of it. A third case is in the constellation Lyra, one of whose stars of the fourth magnitude can be seen by the naked eye to be composed of two separate stars. But only a very good eye can distinguish them from a single star.

When the heavens are scanned with a telescope, it is found that a great many stars which seem single to the eye really consist of two such objects in close proximity. Sometimes these are of the same brightness, but more commonly one is much brighter than the other. Very frequently the small companion is so faint and so close to the large one as to be lost in the glare of its light, except when very carefully examined by an experienced observer. Such pairs are called double stars.

The first question suggested by these objects is whether the two stars appear in such close proximity merely because they chance to be on the same straight line from us, or whether they are really in each other's neighborhood. The latter is known to be the case, for two reasons. In the first place these double stars are vastly more numerous than they would be if their proximity were merely accidental. Another conclusive proof is afforded by the fact that in many such cases the two stars are found to be revolving round each other, or the small one round the large one, as the case may be. The name *Binary System* is applied to such pairs. The most important and interesting conclusion drawn from the motions of these systems is that the law of gravitation extends to the stars. It is true that we could scarcely doubt such to be the case, even were no such proof available; but it is nevertheless of interest to have independent evidence of it. The revolution of the two stars round each other is in all respects similar to that of the earth and planets round the sun, or that of the moon round the earth. But the motions are so very slow that only in a few cases has a binary system made a complete revolution during the period through which observations extend. In the vast majority of cases, hundreds or even thousands of years are required to complete a revolution. As exact observations have only been made on these bodies since the time of Sir William Herschel, there are few of which the orbits and periods are accurately determined. Thus although the whole number known amounts to several thousand, the determination of the orbits goes on very slowly.

There are two binary systems of special interest because the companion was first discovered through its attraction upon the larger star. One of these cases is the brightest star in the heavens, Sirius. About 1840 it was discovered by comparing observations made since the time of Bradley (1750) that Sirius did not move forward on the celestial sphere with a uniform and even motion, as the other stars did, but that there was a slight irregularity. A few years later a careful investigation of the observations showed that Sirius was moving in a very small orbit with a period of about 50 years. This made it possible to calculate the orbit of an unseen companion which, moving round the star, wo·ild produce the apparent orbital motion. In 1860 Alvan Clark, the son and successor of the celebrated maker of telescopes in Cambridgeport, Mass., on pointing one of the newly made great instruments at Sirius, saw a companion star. He knew nothing about the computations that had been made on this object, but when his observations were compared with them, this companion was found to lie in the right direction to produce the observed inequality. The observations since made show that it is going round in the orbit prescribed for it before its discovery.

The other case is that of Procyon, the brightest star in the constellation Canis Minor. Its motion was found to be affected by an inequality somewhat smaller than that of Sirius; but the companion which produced it evaded the scrutiny of the most careful observers until it was discovered by Schaeberle with the great 36-inch telescope of the Lick Observatory. It also was found to be moving in the orbit computed for it before its discovery.

As the power of the telescope has been increased closer binary systems having shorter periods have been continually brought to light. This raises the question whether there may not be vast numbers of such systems in which the two stars are so close together that no telescope will separate them. This question has been answered in recent times by the aid of the spectroscope. We have already described how the radial motions of stars or the motion in the direction to or from our system, is measured by this instrument. The determinations have been going on since 1880. As the number of measures increases, it is found that the radial motion of many of these stars varies in a regular period, thus showing that invisible planets are moving round them. It now seems likely that about one tenth of the whole number of stars show variations of this kind. A new feature of the universe is thus brought to our knowledge, which, if we had no other instrument than the telescope, would remain forever hidden. The difference between the measures made with the telescope and the spectroscope consists in this: The telescope can show the change in the position of a star only when it is great enough to be visible at the enormous distance of the star. Commonly this change must be measured by hundreds of millions of miles, nay, thousands of millions, else it would never be seen in the telescope. But the spectroscope shows, at any moment, how fast the star is moving to or from us, though it gives us no information as to its actual distance. It is not, therefore, necessary that the star should have moved through a

Digitized by Google

definite space in order to have its motion detected by the change in its spectrum. Having given the speed of the revolution and the period, it becomes possible to determine the size of the orbit.

Pairs of stars discovered with the spectroscope are called *spectroscopic binary systems*. It now seems likely that one tenth of the whole number of stars may really be members of such systems, having dark companions of considerable mass moving about them. Although dark companions are the rule, they are by no means universal. The revolutions of a pair of stars, both of which are bright, may be determined with the spectroscope as if one of the bodies were dark. In this case the lines of the spectrum are sometimes double and sometimes single. They seem double when one star is moving from us and the other toward us, and single when the stars are moving laterally to the line of sight from us to them. Thus bright double stars are shown by the use of the spectroscope which no telescope, however powerful, can distinguish to be more than a single star.

The most successful discoveries in this line have been made in recent times by or under the direction of Prof. Campbell, in the Lick Observatory, where it may almost be said that a new branch of astronomy has been created. The discoveries of these objects are now going on so rapidly that it is impossible to set any limit to their number. The general rule is found to be that the orbits described do not differ greatly in magnitude from those described by our planets in moving round the sun. That is to say, there are few or no orbits yet known which are as large as that of Neptune. There is, however, no limit to the minuteness of the orbits, some stars revolving almost in contact with each other.

Besides double stars, there are triple and quadruple stars of such variety that it is impossible to give any general description of them. The most remarkable quadruple system is found in the great nebula of Orion, where Theta Orionis, which looks to the naked eye like a single star, is shown by the telescope to consist of four stars forming a trapezium; this is therefore known as the trapezium of Orion. Altogether, these systems show the infinite variety of the great bodies which make up the universe. The pairs of stars which form a binary system may be of every degree of brightness and of very different masses. Their times of revolution range from two or three days to unknown thousands of years. In a few cases the masses have actually been determined. It is a curious fact that they do not vary so much as does the brightness of the stars. When a bright and a faint star form a binary system, the mass of the faint star is generally out of proportion to the amount of light it emits. We have already remarked that many stars are thousands of times as bright as the sun; but it is a curious fact that none have been found to have even hundreds of times the mass of the sun.

Variable Stars.— To ordinary observations, even to observations extending through generations, the light of the stars seems to be as permanent as the order of Nature itself. But, although this is true of the great majority of stars which stud the heavens, it is now found that there are exceptions to the rule. So numerous have these exceptions become that the study of variable stars has developed into one of the important branches of astronomy. The first star which was found to be variable in its light is known as Mira Ceti, or the wonder of the constellation Cetus, the Whale. This constellation extends from 2 h. to 3 h. of right ascension, and its central regions are situated a little south of the equator. It is on the meridian at some hour in the evenings of the winter months. The star Mira is quite invisible to the naked eye the greater part of the time, but is found to blaze up at regular but slightly varying intervals of about 11 months, sometimes attaining to the second magnitude. After remaining visible to the naked eye for a few days, it gradually fades away into invisibility, but may always be seen in a telescope. Its greatest brightness varies markedly. Sometimes it brightens up only to the fifth magnitude, and is then not at all conspicuous.

There are two other remarkable variable stars. One is Algol in the constellation Perseus, which may be seen in some part of the northern sky at some hour on almost any night of the year except in April and May. Commonly this star is between the second and third magnitude, and is usually classified as of the second magnitude. At regular intervals of a little less than three days, it fades away to the fourth magnitude, and then, after a few hours, gradually increases again to its regular brightness. It is now known that this diminution of light is a partial eclipse of the star produced by a dark planet, nearly or quite as large as the star itself, revolving round it.

Another class of variable stars are double stars revolving round each other, which eclipse each other's light alternately. The most remarkable of this class is Beta Lyræ, quite near the bright star Vega. It may be seen in some part of the northern sky during the spring, summer and autumn. Although the changes in its light are not striking, one who looks at it carefully night after night will notice them.

These three stars are only examples of a number of such objects now known to approach to 1,000, scattered over the whole sky. As observations become more and more accurate, it is found that quite a number of the stars visible to the naked eye are subject to slight fluctuations of light, mostly in a more or less regular period, but sometimes in a quite irregular way. Spectroscopic observations render it somewhat probable that in most cases the regular changes are produced by bright or dark bodies revolving round the star in very eccentric orbits. Sometimes they partially eclipse the star, as we have already mentioned; but in many other cases it seems likely that they make the star blaze up by the disturbance they make when they approach close to it in their orbits.

The general rule is that a variable star goes through its series of changes in a regular period. At a certain day and hour it reaches its least brightness, which is called a *minimum*. Then it begins to increase in light. In the course of a certain number of hours or days it increases to its greatest brightness; then it begins to decrease and once more fades away to its minimum. The length of time between two minima is a *period*. Commonly the successive periods of

Digitized by Google

a variable star are nearly equal to each other, so that the stage of brightness at any future time can be predicted with confidence. The periods range very widely from a few hours to about 600 days. It is very remarkable that no period yet known exceeds two years. There are many periods less than a month; but there are only eight between 50 and 100 days. The number then increases up to 350 days. The greatest number of periods is just about one of our years, a coincidence which of course is a pure accident. Above this their frequency rapidly falls off. This limitation of the period strengthens the view that the variability of a great number of stars is produced by the disturbing action of an immense body revolving round the star in a very eccentric orbit.

New Stars.— In past generations, when the whole universe was supposed to be only a few thousand years old, it was quite natural to expect that new stars would from time to time be created to shine among their fellows. But this view has now to be modified. It is true that, from time to time, a star is seen to blaze out where none was known before. But the theory of a new creation is refuted by the fact that such stars invariably fade out in the course of a few weeks or months. On some very rare occasions they have continued visible to the naked eye for a year or more, and they can commonly be seen by the telescope for several years. The first remarkable case of this sort of which we have a scientific record occurred in 1752. On 11 November of that year Tycho Brahe, the celebrated astronomer of Uraniburg, observed a star of the first magnitude in the constellation Cassiopeia. Before the end of the month it was so bright as to be visible in full daylight. Then it began to fade away and finally disappeared from view in May following. This was before the invention of the telescope, so that Tycho was unable to trace the star any longer. Thirty-two years later Kepler observed a similar star in the constellation Ophiuchus. This star continued visible to the naked eye for more than a year, but it never became so bright as the star of Tycho. As the heavens were more carefully watched, and photographs of the stars were taken, these new stars were found to be more frequent than was formerly supposed. During the 19th century, 11 were observed to blaze out, more than half of which were during the last 14 years of the century. But the greater number of them scarcely reached the limit of visibility to the naked eye, being discovered principally by photography. On 20 Feb. 1901, the most wonderful of these objects which had been seen for 300 years blazed out in the constellation Perseus. In two or three days it was the third brightest star in the heavens. Then, following the example of its predecessor, it gradually faded away, though it still remains visible in the telescope. It is not yet certain whether this object was impressed on any photographs until within a few days of its first appearance.

By what convulsion of nature these objects burst forth, it is quite beyond the power of our present science to decide. It is certain that the amount of light and heat emitted by the star was suddenly increased hundreds or even thousands of times. One of the most plausible explanations is that of a collision. It is supposed that the star itself may have collided with another — perhaps a planet in its neighborhood — or rushed to its own destruction in some nebulous mass. But this is only conjecture.

Very curious has been the fate of these objects after they have faded away. Those recently observed have been found to change into nebulæ; a mass of glowing gas emitting the bright spectral rays of hydrogen and other gases. Photographs and spectroscopic observations give evidence of some explosive action, throwing out corpuscles with immense velocity in every direction, but throw no light on the origin of the explosion.

Star Clusters.— One of the remarkable features of the heavens revealed by the telescope consists in star clusters — great numbers of these bodies crowded into a space which, measured by the expanse of the heavens, must be comparatively limited. It is not at all uncommon to find hundreds of stars in a single bunch so closely packed together that, to the naked eye or in a small telescope, nothing is seen but a minute patch of light. One of the most remarkable of these is situated in the constellation Hercules. Another in the constellation Centaurus was described by Sir John Herschel as one of the most remarkable objects in the heavens. There exists every variety of such clusters, from these closely packed ones to the agglomerations of the Milky Way, which any careful observer of the heavens can see on any clear evening during the late summer and autumn. Close together as the component stars of these clusters appear to be there is no doubt that they are really separate from each other by distances vaster than those which separate the planets of our solar system; otherwise the most powerful telescope would not distinguish them as separate stars, but present them to our view as if confused together in one mass of light. It is therefore quite possible that these objects may have planets revolving around them. This, however, is a mere probability, not an established conclusion.

It is a remarkable fact that many of these clusters contain a great number of variable stars. This fact, taken in connection with the probable cause of variability already mentioned, makes plausible the idea that close binary systems are very numerous in the clusters. If, at any one moment, all the stars of the cluster were at rest, they would in course of time be drawn together by mutual gravitation. Each star must therefore be in motion relative to the others, describing some kind of an orbit around their centre of gravity.

The laws of revolution in cases like this must be very complicated, but as they require thousands of years to go through their changes and accurate observations have been made for hardly more than a century, astronomers are not yet able to investigate them fully.

Constitution of the Stars.— There is no reasonable doubt that the general constitution of the stars is the same as that of our sun; and that they consist of masses of intensely hot vapors of the substance composing them, compressed together by the mutual gravitation of their parts. As we have already said, the stars are composed in the main of the substances found to exist in the sun, but, probably, in a great variety of forms as regards density and temperature. The spectra of the stars, consisting,

Digitized by Google

as most of them do, of a bright continuous spectrum crossed by dark lines, show that we see the luminous surface through an atmosphere cooler than itself, though really intensely hot.

The stars differ enormously in their actual luminosity, that is the actual amount of light emitted by each. If they were all equally luminous we could form an idea of their relative distance by their brightness; the farther a star was away, the fainter it would shine. But as a matter of fact, some of the brightest stars in the heavens are so distant that their parallax proves to be immeasurably small. This is not the case with Sirius, the brightest of all, which has a parallax of 0″.36, showing it to be situated at a distance from which light would travel in about 13 years. But the next brightest, Canopus (not visible farther north than our Southern States), is so distant that no parallax can be shown by the most refined measures. The conclusion is that it must be 10,000 times as luminous as our sun; possibly 100,000 times. This is the case with several stars in or near the constellation Orion. At the other extreme, we find that among the nearer stars, are several not visible to the naked eye. It is true that the nearest of all, Alpha Centauri, is nearly of the first magnitude; but the next in order, 61 Cygni, is only of the fifth magnitude; two others are quite invisible to the naked eye. This shows that there are stars much less luminous than the sun, and that the greatest stars are probably millions of times more luminous than the smallest ones.

Literature.— 'The Stars: a Study of the Universe,' by Simon Newcomb (New York 1901); 'Problems in Astrophysics,' by Agnes M. Clerke (London 1903). SIMON NEWCOMB.

Stars and Bars, The, a name applied to the flag of the Confederate States of America. It was an adaptation of the stars and stripes. On 5 March 1861 the Flag Committee appointed in the Provisional Senate of the Southern States recommended that "the flag of the Confederate States shall consist of a red field with a white space extending horizontally through the centre, and equal in width to one third the width of the flag." It was first displayed 4 March 1861, simultaneously with the inauguration of Lincoln, being unfurled over the State House at Montgomery, Ala. In 1863 the Confederate Senate adopted a white flag with one blue star in the centre, the Stars and Bars bearing too close a resemblance to the Stars and Stripes.

Stars and Stripes, The. See FLAG, THE AMERICAN.

Starva'tion, or **Inanition.** The phenomena of starvation present subjects of great interest from their bearing upon phenomena induced through the inability to take nourishment occasioned by some diseases. According to Chossat, the symptoms which intervene in starvation are at first marked by a very rapid diminution in the weight of the body; this decrease, however, becoming more gradual as death approaches. A striking uniformity is found between the period at which death results from starvation and the loss of weight experienced. Thus Chossat found that in different warm-blooded animals death resulted when the body had lost about 40 per cent or two fifths of its original and normal weight. Great variations undoubtedly existed in the extremes of Chossat's cases; [illegible] powerfully [illegible] the amount [illegible] to the beginning [illegible] animals wh[illegible] weight quick[illegible] longest. Chossat [illegible] going starvation [illegible] the first half or [illegible] those of calmness and [illegible] ture then becoming [illegible] agitation prevails; and [illegible] by the rapid fall of the [illegible] pervenes. The extremities [illegible] weak, and are finally [illegible] weight of the body; while [illegible] become dilated; and occasion[illegible] vulsive twitchings may be pres[illegible] are small in quantity after [illegible] voided as the result of the food [illegible] and consist chiefly of greenish mat[illegible] derived from the biliary secretions [illegible] the fæces become watery, and conta[illegible] matters.

The fatty matters are almost entire[illegible] moved by starvation, and the blood [illegible] fourths of its original amount. It is [illegible] that the total nutritive powers of the body [illegible] ing starvation go to nourish the nervous t[illegible] the loss of which is very small; while the [illegible] mode of death from starvation appears to be death from want of heat, the body being preserved alive, notwithstanding the want of fresh nutritive material, by the combustion or absorption of the fatty matters it contains. Chossat also found that proportionally to the more active nutrition and waste in young animals, such died sooner from starvation than older forms; and he also determined the equally important fact that if young animals especially are supplied with an insufficient amount of food, they succumb as if they were actually starved; the process of starvation being of necessity more gradual in the latter instance. The mere variations in the temperature observed by Chossat formed more prominent points of note in his observations than the actual decrease of heat. It fluctuated or varied daily, in some cases, some 5° and 6° F. instead of 1° and 2° F., as observed in the normal and healthy state of the body. In the human subject the symptoms of starvation have been closely studied by physiologists, with the effect of determining a stated order in their appearance and effects. The preliminary hunger appears to be accompanied in the first instance by severe pain in the stomach and epigastric region generally. The thirst becomes intense, and although undoubtedly in man the want of water induces death at a much earlier period than where drink is attainable by lower forms (for example, birds), the want of water may in reality make comparatively little difference in the invasion of the fatal period. Sleeplessness appears to be early manifested; the severe pain at first felt in the stomach gradually ceasing. A characteristic feeling of sinking and weakness is described as occurring in the epigastric region, the thirst still continuing to an agonizing degree. The face assumes meanwhile an anxious, pale expression; the eyes are wild and staring; and the whole countenance and body participate in rapid general emaciation. The body latterly exhales a fetid odor; the breath and lung secretions become strong-

Digitized by Google

smelling; and the skin is said to become covered with a brown secretion — these results, doubtless, arising from the decomposition and organic decay of the tissues. The gait totters, the mind becomes impaired, delirium or convulsions may ensue, and death occurs, with or without the accompaniment of diarrhœa. Postmortem reveals a state of anæmia in all parts of the body but the brain, which appears to the last to receive a due supply of blood. The fat is entirely wanting, and the various organs and tissues have greatly lost in bulk. The coats of the small intestine are found exceedingly thin. The gall-bladder generally contains much bile, and the body goes more rapidly to decay than after death from ordinary causes.

Starvation suggests inquiries respecting abstinence in diet and from various or particular kinds of food. A sudden and unfavorable change in a given dietary may induce, in virtue of the new food containing a low percentage of certain nutritive matters, symptoms analogous to those of starvation. Want of nutriment produces an incapacity for the digestion of whatever amount is supplied, a result probably due to nervous causes, and primarily perhaps to the want of stimulation of the appetite through insufficient secretion of gastric juice.

Where the temperature of the body is maintained in tolerable efficiency, life may be prolonged for great periods without food, a state of syncope prevailing — as in several noted cases of so-called apparent death. It was found by Chossat that in the case of animals whose death seemed imminent from starvation, restoration took place primarily by the application of artificial heat. They thus manifested activity, and were able afterward to partake of food. From 8 to 10 days is regarded as the usual period during which human life can be supported without food or drink. If water be given this period may be greatly exceeded, and where a moist condition of the atmosphere exists life may for the same reason be prolonged. A case is recorded in which some workmen were dug out alive after 14 days' confinement in a cold damp vault; and another is mentioned in which a miner was extricated alive after being shut up in a mine for 23 days, during the first 10 of which he subsisted on a little dirty water. He died, however, three days after his release. Life has been prolonged for 60 days in a person suffering from religious mania who abstained from food, supporting his existence by sucking an orange. In some remarkable cases of nervous hysteria and other diseased conditions no food may be taken and yet the body be perfectly sustained. The system is disposed or becomes inured to the abstinence, just as under other conditions it exhibits a want of susceptibility to the ordinary effects of certain medicines, etc. Consult: Leeson, 'Death from Starvation,' in 'Dublin Medical Press' (1847); Virchow, 'Der Penge-Fall,' in 'Berliner Klinische Wochenschrift' (1877); Davies, 'Starvation,' in 'Popular Science Monthly' (1884–5, xxvi.).

Starving Time, in American colonial history; in 1609, after the departure of Capt. John Smith for England, the settlers of Jamestown, Va., were, during many months, reduced to the last extremities, being obliged to eat rats, snakes, toads, and even dead bodies to prevent starvation. This was known as the «starving time.»

Stass'furtite, a massive variety of the mineral boracite (q.v.) occurring chiefly at Stassfurt, Germany, where a few hundred tons are annually produced.

State. Political scientists of the present day distinguish sharply between the idea connoted by the term «state» and that indicated by the word «government.» By «state» is meant the body-politic abstractly considered,— the entity that possesses and exercises the sovereign political will. By «government» is meant the mechanism of political rule, the ensemble of the agencies through which the tasks of the state are performed. The present article will be devoted to a discussion of the nature of the state. A treatment of GOVERNMENT will be found under that title.

As distinguished from a society, by which is meant simply an aggregate of human beings living together and united by mutual economic and social interests, a state is a body of individuals that has assumed an organized form, that has a definite membership, and has created for itself specific organs for expressing and enforcing its corporate will. Thus, in order that there may be a state, three elements must be present: (1) An aggregate of human beings, individually termed citizens or subjects, forming a single group, and as such termed a «people»; (2) a political apparatus, termed a government, and administered by a corps of officials collectively termed a magistracy; and (3) a body of rules or maxims, written or unwritten, which are generally recognized to be such as may rightfully be enforced by those entrusted with the exercise of the powers of the state. Whether or not to these three essential elements there should be added a fourth, namely, a definite area of land, there is a difference of opinion. The eminent German publicist Bluntschli, who may be taken as a representative of one view, defines a state as «the politically organized national person of a definite country.» On the other hand, Holland declares that «a state is a numerous assemblage of human beings *generally* occupying a certain territory, among whom the will of the majority, or of an ascertainable class of persons, is, by the strength of such a majority or class, made to prevail against any number who oppose it.» The definition of Bluntschli is undoubtedly applicable to all modern civilized states, but certainly is not descriptive of very many bodies-politic of the past. Indeed, political sovereignty, by which is meant the supreme power of the state, was for many years, according to the ideas of the peoples of western Europe, not territorial at all, but based upon a personal allegiance of the subjects to their rulers.

A people, a government, and a body of laws are what may be termed the essential material elements of which a state is composed. In addition to these there is one characteristic that it must possess in order properly to deserve its title, and to be distinguished from the others and lower types of political life. This unique and distinguishing characteristic is sovereignty. By sovereignty is meant the highest, or supreme power. It thus means that its possessor is itself the ultimate source of all the laws that are en-

Digitized by Google

forced over the territory which it claims as its own, and over citizens or other persons subject to its authority. It means, in short, formal legal omnipotence. The word formal is used, for of course the power of control that any state may actually exercise is limited by the intolerance of its subjects of oppression. But, formally, a state, because legally subject to the control of no other law-making power, has the power to issue such legally binding commands as it sees fit. Directly or indirectly, it is the source of all the rules that regulate not only the conduct of its subjects, and others for the time being subject to its authority, but those that determine the form of its own government, and the respective powers of its several organs and officials. The exercise of all political powers, either by individuals or associations of individuals, are, therefore, validated only by its sanction. The state is thus legally supreme not only as the ultimate source of all law, but is itself the determinator of the matters that it will regulate, and the manner in which it will regulate them. Thus as the Austrian publicist, Jellinek, has put it: «Obligation through its own will is the legal characteristic of the state.»

It is the state, it is to be observed, that is the possessor of sovereignty — its «subject,» as continental writers express it — not the government. To the government is entrusted only the execution of the sovereign will of the state. The powers of each governmental organ and of each public official are obtained from the state and are limited and defined by its laws. Thus at any given time a citizen, though potentially subject in every matter of life, liberty, and property to the will of his state, possesses a sphere of freedom, defined by existing laws, upon which those exercising political authority may not trespass. To quote the words of Professor Burgess: «The individual is defended in this sphere against the government by the power [the state] that makes and maintains and can destroy the government; and by that same power through the government, against encroachments from any other quarter. Against that power itself, however, he has no defence.»

Sovereignty is an attribute of a political body that has to be demonstrated as a matter of fact, and not as a matter of law. In other words, there is no proper distinction between *de facto* and *de jure* states, these terms being applicable only to governments. (See GOVERNMENT.) If a given community of human beings, yielding a general obedience to an established government, asserts and fairly demonstrates that it is able to maintain a freedom from the control of any other political power, it becomes by that very fact a state, and is entitled to recognition by other states as such. It is, however, the actual fact of independence from foreign control and maintenance of domestic order that demonstrates the existence of the sovereignty of the state in question, and not its recognition as a state by the other powers. Thus, for example, the American colonies ceased to be dependencies and became states not by reason of their recognition as such by England and European nations, but because of their actual ability to maintain that freedom from Great Britain's control which they formally asserted in 1776. The sovereignty of a state thus bears a double aspect. Considered internally, that is, from the viewpoint of municipal law, it appears as legal omnipotence. Looked at from the viewpoint of its relations to other states it appears simply as independence. In the one case, it means the affirmative legal power of enforcing its will upon all those subject to its authority. In the other case, it signifies simply freedom from foreign control. From the domestic standpoint, it signifies supremacy. From the international standpoint, it means equality.

The state, though itself the source of all law, can only operate through law. That is to say, an expression of its sovereign will can validly proceed only from those legislative mouthpieces that, by already existing law, have been granted the right to voice its commands, and these commands may be legally enforced only according to laws already established. Because of its legal omnipotence the state may at any time alter these rules according to the methods provided for the amendment or repeal of laws, but as they exist at any time the laws control. Any action not sanctioned by their provisions, however much approved by those in political authority, cannot, strictly speaking, be termed an action of the state.

Itself the creator of all law, the state is not itself a product of law. Constitutions create governments, not states. They are the creations of states already existent. The creative force, in the birth of states, is that feeling of unity interests and desires that leads a society of human beings to assume a corporate form and create the political organs necessary for the attainment of all those interests that are connected with or arise out of their existence as a national unit. This being so, it follows that sovereignty cannot arise out of any formal, legal or conventional act. In other words, a state cannot be created by formal agreement between individuals, as postulated by the social compact theory, nor brought into being by a compact between sovereign states. By a surrender of private rights, individuals cannot create a public right; by a treaty agreement, there cannot be created a political power with a legal authority superior to that of the parties establishing it. From this last fact it irresistibly follows that any so-called composite or federal state that has for its basis a treaty or compact between states is not in truth a state at all, but a mere league of states, and this, notwithstanding the fact that very extensive powers may have been granted to the central governing power. Envisaged as a legal person, the sovereignty of a state represents the supremacy of its will. As thus representing a supreme will, sovereignty is necessarily an indivisible unity. A divided or double sovereignty is an impossibility. A given body-politic therefore either possesses sovereignty and is for that reason a state, or it has not sovereignty, and, as a result, is not a state but simply an administrative division of the state that possesses sovereignty over it. In all strictness then, it is a misuse of words to speak of a federal state, if by that term is meant a state formed by a federation of states; for if, in such a federation, sovereignty is held to rest in the central body, that body is a state, and its constituent commonwealth members are *ipso facto* reduced to a non-sovereign condition, and therefore to the status of administrative districts. If, however, the federating units each retain their sovereignty, they remain states, and no central sovereignty

Digitized by Google

or state can be held to be created. In the one case, there exists but one state with a government composed of one set of central or federal organs and as many sets of local governmental organs as there are members of the union. In the other case, there exist as many states as there are confederated units, an equal number of state governments, and a central government that acts as the common agent of the several states; but no central state.

The line of distinction between a single national state composed of non-sovereign bodies-politic enjoying extended powers of self-government, and a confederation of states with a central government exercising many of the most important sovereign powers, is not always easy to draw. The distinguishing criterion is not the amount of powers actually vested in the central government as compared with those retained by the individual commonwealths, nor whether the operation of federal law is upon the individual states themselves or directly upon their citizens, nor, necessarily, upon the manner in which the articles of union may be amended. The one absolute test is as to the power or lack of power of the members of the union themselves to determine, in the last resort, not only the extent of the obligations imposed upon them by the articles of union, but their constitutional right to withdraw from the union when they see fit.

Bearing in mind the distinction between the possession of the sovereignty itself, and the mere exercise of certain of its powers, it is seen that a state may, without in any wise impairing its sovereignty, delegate the execution of its commands not only to governmental agencies of its own creation, but to those of other states; for, so long as such other states, or their governments, act but as the agents of the first state, it is the sovereign will of that state that is executed. And, furthermore, whatever may be its actual power, the state in question has the legal right itself to assume again the actual exercise of the powers it has granted. Such a withdrawal of delegated powers may be in violation of existing treaties, and therefore constitute a just ground for complaint, but it is not an illegal act, for treaties do not create law in the strict positive sense. Instances of the delegation by states to other states of the exercise of important powers is seen in the many so-called protectorates that exist at the present day. Confederacies, real and personal unions, and colonies are not similar examples, for in them the exercise of powers is granted to governmental organs created by the sovereign parties themselves.

Theoretically, there is no limit to the extent to which a state may go in the delegation to other states of the exercise of its power. If, however, in any one respect it is absolutely deprived of a power, so that it cannot legally, at its own discretion, resume the exercise of it, its legal omnipotence is destroyed and, together with it, its sovereignty and right to the title state.

Because the denial of the name state to non-sovereign powers makes it necessary to refuse that title to the many bodies-politic that generally have been, and are, so designated, as for example, the members of a federation such as the United States of America, many writers have endeavored to discover some distinctive attribute other than sovereignty that will serve sharply to distinguish states from provinces, departments and other simple administrative districts. The better opinion would seem to be, however, that these efforts have failed, and must continue to fail. With the test of sovereignty discarded, the dividing line between states and other political bodies becomes an indeterminate one, and, therefore, an exact definition of a state an impossibility. Logical exactness, therefore, even at the expense of wounding political sentiments, requires an adherence to the definition of a state as a necessarily sovereign body.

Bibliography.—(1) *American:* Baldwin, 'The Province of Jurisprudence Determined' (1898); Burgess, 'Political Science and Comparative Constitutional Law' (1893); Crane and Moses, 'Politics' (1893); Lowell, 'Essays on Government' (1899); Woolsey, 'Political Science' (1878); Wilson, 'The State' (1889); 'Willoughby, 'The Nature of the State' (1896); Wilson, 'The State' (1889). (2) *English:* Bosanquet, 'The Philosophical Theory of the State' (1899); Green, 'Lectures on the Principles of Political Obligation' (1893); Lilly, 'First Principles in Politics' (1899); Lorimer, 'Institutes of Law' (1880); M'Kechnie, 'The State and the Individual' (1896); Seeley, 'Introduction to Political Science' (1896); Spencer, 'Justice' (1892). (3) *German, French, etc.:* Ahrens, 'Cour de Droit Naturel' (1892); Bluntschli, 'Allgemeine Staatslehre' (Eng. trans 'The Theory of the State') (1892); Jellinek, 'Das Recht des modernen Staates. Erster Band, Allgemeine Staatslehre' (1900); Gneist, 'Der Rechtsstaat' (1879); Kant, 'The Philosophy of Law' (Eng. trans. by Hastie) (1887); Le Fur, 'Etat fédéral et confédération d'états' (1896); Passy, 'Des Formes de Gouvernement' (1876); Schmidt, 'Der Staat' (1896).

W. W. Willoughby,
Johns Hopkins University,
Baltimore, Md.

State Board of Equalization. See Taxation.

State Courts. See Court.

State, Department of, one of the executive departments of the United States government, presided over by the secretary of state (q.v.), who is a member of the cabinet, and next in line to the Vice-President for the Presidency. The department was established by Act of Congress, 27 July 1789. Through this department communication is made between the United States government and any of the States or any foreign country. The department has charge of the great seal of the United States; of all ambassadors and consuls, and in its custody are all engrossed copies of the laws of the United States and of all treaties. There are three assistant secretaries in the department and a large force of clerks, translators, librarians, and other employees.

State Militia. See Militia.

State Sovereignty. See Popular Sovereignty.

State Taxation. See Taxation.

State Universities, The. There has perhaps been no movement in American life so expressive of the free, elevated, and determined

Digitized by Google

spirit of American democracy as that which has established tax-supported universities under public management, and developed them until, in their offerings, in the quality of their teaching, and the extent of their investigational work, in the attendance of students, and in the respect in which the common sentiment of the country holds them, they are close rivals of the oldest, the largest, and foremost universities of the land.

The early thought of educated American pioneers was that the state should encourage — not wholly manage and support — all educational activities. It was believed that the elementary education of the masses would take care of itself rather easily, without help from the State, because it was so rudimentary and because of the natural interest of the people in it. Even more, it was clearly the thought of the English government, which was at first dominant in American educational opinion, that the education of the masses to an extent which would enable them to read the Bible and learn the catechism was all that was desirable, or, at least, all that it was well for the state to support with its means. It was not at all in the thought of the nobility, the rich, or the well educated — and all of these classes were well represented in and began to manage matters for America in the beginnings — that the state should assure educational opportunity to all and give every one his chance to attain distinction if he had the material and the power in him. It was their belief that the children of the poor should know enough to read what might keep them from going to theological perdition, but not enough to encourage any latent tendency which might lead them to interfere with the high and mighty in managing the business and skimming the cream of the world. So education, generally speaking, was held to be a parental or a local concern, and it was sufficient if those in authority told parents and communities of their duty to teach their own children enough to enable them to read and write.

But this was not enough for the children of the upper class, of whom it was supposed to be ordained that they should manage the business and skim the cream of the world after their fathers were gone. These must have the advantage of college training, to the end that they might be fitted for service in the state and in the Church; and in the convenient thought of the times the state must provide the colleges until they should become sufficiently endowed to be self-supporting. In this way the first public moneys expended for education in America went to the starting of colleges, and, in a sense, the first colleges in the New World were state institutions; as soon, however, as strong enough they ceased to depend upon the state, and have since sustained an independent and most serviceable existence of their own.

In New England, from the time that the colleges could sustain themselves, the States made no grants to the support of education, because they conceived that the duty devolved upon parents and local communities, and that State support was not necessary. In the Middle States the same course was pursued, except that the policy of distributing State funds, by way of encouraging elementary schools and of enlarging State direction in reference to them, for the purpose of protecting a steadily widening suffrage, was followed.

The institutional foundations of the great States west of the Alleghanies were laid by emigrants from the Eastern States, and not until common elementary schools were universal, and either academies or public high schools were widely accepted, and the value of colleges for all was coming to be somewhat recognized in the East. The settlers of the newer States carried the very best ideals of Eastern education to their Western homes, and they were not fettered with the hindrances of established thought in even improving upon these ideals. Democracy was free and strong in the West. There were no class divisions whatever. They cared little for conventionalities or previous conclusions. All were united in a determination to improve upon the life and opportunities of the East and to give their children better educational privileges than they had themselves enjoyed, or than they would have had if they had remained in their earlier homes.

Accordingly, public higher institutions of learning entered into the State policies of the West at a very early day. In many States public universities were provided for in the first State constitutions. The same thing happened in a number of the Southern States. Therefore we find a number of State universities whose foundations date back to years preceding 1850. Of course these institutions were nothing beyond colleges in their early years, but the same was true of all the advanced institutions of the country at that time. There seems to be no doubt about the best of the State universities, like those of Michigan and Wisconsin, doing as substantial work as any American institution before 1860.

The Land Grant Act, passed by Congress and approved by President Lincoln (after having been once vetoed by Mr. Buchanan), in 1862, whereby the Federal government gave each State a right to 30,000 acres of certain public lands for each senator and member of Congress which the State had in the national legislature, for the endowment of the State university, exerted a telling and lasting influence upon these institutions. In the last 40 years practically every State west of New York and Pennsylvania has not only availed itself of this and further national grants, but has supplemented these grants with State appropriations, which have often been far beyond the amounts received from the general government.

In some cases, as in Michigan and Iowa, the State university was continued independently and a land grant agricultural and mechanical college was developed separately; and in others, like Illinois and Minnesota, the two were combined in one institution. The latter course was commonly taken where the State was wholly free in the matter. In either case the State university became a component part of the State educational system. In all of the Western States there are really 16 grades in the public school system: 8 in the grammar grades, 4 in the high school, and 4 in the State university. The course through the whole system is con-

Digitized by Google

tinuous, and students pass from the school below to the one above on certificate of the lower school that they have completed its work. There is no difficulty about this, for the schools above steadily overlook the work below them. The State universities send committees or visitors to all of the high schools to overlook the teaching of the courses of study which have previously been suggested by the university and in practice have come to be universally used. In a word, the university examines the schools which are to send students to it, instead of examining the students when they apply for admission. Of course, under this system some students get into the university who can not sustain themselves there, but the number is not large, for failures of students is held to reflect upon the secondary school certifying them. And it is no killing matter if some students do break down in the university, provided the degrees conferred at the end of four years of university work rest upon an adequate foundation, as in practically all of the State universities they certainly do. Aside from that, the influence of the schools above upon the schools below, because of this general plan, is more stimulating and goes farther to consolidate and solidify a school system of wider range than is found in the older States which are without State universities.

The influences of the land grant legislation are very apparent, not only in the size but even more in the kind of work of the State universities. None of them is without the old-time literary college, but all of them have developed strong industrial colleges. They were required to do this by the congressional acts, but it was the Western States that framed the congressional acts, and those acts required them to do precisely what they wanted to do. They believed that there was culturing and disciplinary value in manual work as well as in the study of books, and that it was the legitimate functions of the advanced schools of a people to apply scientific investigation and its results to that people's industries and vocations.

Therefore, while in all of the State universities there are colleges of liberal arts where modern and ancient languages and literatures, with history and philosophy and the political sciences, as well as the scientific study of nature, are pursued, there are in practically all of them great industrial colleges where students are trained in the branches which must develop the resources, accumulate the available wealth, and unfold the legitimate strength and power of the State. In agriculture the constituent elements of the soil are chemically studied with a view to determining the adaptability of crops and the need of new elements for permanent potentiality: the breeding, care, treatment, and use of animals have every attention, and all of the economic questions relating to the happiness and usefulness of life upon the soil are discussed with enthusiasm. Nor is that all: the universities maintain great experimental farms, with fields and orchards and herds of horses, cattle, sheep, and swine, to prove the practical realization of educational theory and scientific demonstration, as well as to afford attractive object lessons to innumerable visitors and observers.

In the mechanical and constructive industries students are trained in architecture and architectural engineering, civil engineering, electrical engineering, mechanical engineering, sanitary engineering, mining engineering, and railway engineering. Great shops and laboratories with costly equipments are maintained, where theories are demonstrated and processes shown, and where enthusiasm is generated for the accomplishments upon which the wealth and strength and happiness of the State must ultimately rest.

All of the State universities admit women on equal terms with men. They are supported by taxation and of course belong to all. There is no distinction between the work of students on account of sex. The right of election in courses is sufficient to accommodate the differing temperaments and inclinations. Men and women work together in the same class-rooms and laboratories, and while they commonly go to different fields for their play because of their different likings in athletic work, they often play together in games which accommodate the tastes of both sexes. With it all an occasional marriage results, but scandals are practically unheard of, and there is not half of the boyish foolishness that prevails in men's colleges nor half of the girlish foolishness to be found in women's colleges.

It ought to be said that the presence of women in the State universities is leading to the rapid development of courses bearing upon home-making and women's distinctive life. House sanitation, decorations, and furnishings, the chemical analysis of foods, and all of the household arts receive much scientific and practical treatment. Of course, the attendance of women gives special emphasis to the study of the fine arts.

Religious life is vigorous and the expression of it is free because it is not hampered by denominational barriers. All of the universities have flourishing Christian Associations, and the atmosphere of the place is intellectually stimulating and morally bracing because of the cosmopolitan character of the student population and the democratic freedom which must necessarily prevail.

At all of the State universities there is a military department, in charge of an officer detailed from the United States army. Often these departments come to have special significance. It is probably not too much to say that the largest and best disciplined regiment in many of the States is to be found at the State university. In one instance, at least, the military organization includes an infantry regiment of 1,100 men, with a battery of artillery, full military band, and all the accessories of military display.

Athletics of every kind receive much attention, and marked proficiency results. The breaking of athletic records has, in recent years, taken place quite as often in the West as in the East. There is not much opportunity for competition between the East and the West. Whatever the reason is, the Western students think that their Eastern compatriots fear competition in open-air sports. Whatever the warrant is for this suspicion, the fact is that when, in a

Digitized by Google

recent year, a base ball team from a Western State university played a series of games with the largest and oldest universities in the East, the Westerners were the winners in every game save one.

Fraternities, with houses of their own, societies of every kind, clubs for every conceivable purpose, abound in all of the State universities.

The attendance has come to be very large. If the 10 largest universities of America are named, 5, if not 6, of them will be State universities.

While these universities are under public management, there is no showing of political, any more than of denominational, influences in their administration. The people have the sense of ownership concerning them, and are extremely sensitive about anything entering into their affairs which is not open and manifest and of common concern and right to all.

It is this sense of common rights and of public ownership in the State universities which is steadily putting them to a great and continually increasing use outside of the training of the sons and daughters of the State. They are rendering a distinct service directly to the commercial and business interests of the State. Farmers are going to the university to be told what treatment their lands need to be more productive, or what crops will yield a larger income than the ones they have been raising, or what system of feeding will turn corn into beef or pork with better dividends upon the investment. One of the State universities has certainly shown that a valuable crop can be produced in the State which it was confidently believed the soil would not yield, and that by a careful process of selection the chemical contents of farm products may be changed so as to materially increase the commercial value. In a region where the crops are so enormous and rivalries so sharp this fact is essential to economic prosperity if not to commercial primacy.

But that is not all. The railroads are going to the universities to learn how to increase the strength of locomotives and the speed of trains with less expenditure of money, and the manufacturers demand to know what scientific applications will enlarge the number and the usefulness of their goods. City officials seek help in constructing waterworks and sewage systems which will not be disappointing, and all the people of the State want to know how to make highways which will bear traffic and promote pleasure at a minimum of cost.

The educational ideals, East and West, in America are very unlike. There are strong points and weak points with each. The Easterners know how to live more deliberately, less ostentatiously, and more comfortably than the Westerners; but the Westerners are rapidly gaining a culture through work, with a promise, if not an understanding, that it must be of the most permanent and enduring kind. In the East the common ideal is to get a good living, and in the West, it is to get a good bank account. But the transforming power of work upon men and women will in time prepare them to use the moneys which result from their work in ways which will be of the largest and most lasting advantage to themselves, or most certainly to their children. These things are reflected in the schools, and an analysis of Western conditions and outlook reveals the distinguishing atmosphere and purposes of the great universities which have been developed by the people of the Western States.

There is no reason for doubt of the permanence of these institutions. When a State has invested more than ten millions of dollars in an institution, it will not abandon it. When a State legislature appropriates from a half million to a million a year, without any dissent, for the maintenance of a university, the proof is not lacking that the people know what they are about and intend what they are doing. There is no endowment so substantial, so enduring, so capable of indefinite expansion as that which rests upon the affections, the commercial interests, the steadily advancing respect for learning, the constantly deepening interest in research, the State pride, and the taxing power of all the people of a commonwealth.

The scientific standing already gained by the State universities, in comparison with the older universities in this and other lands, is entirely respectable and is fast becoming wholly creditable to them. Their graduates, who have heretofore gone to New York or New England for finishing work, are beginning to find that it is no longer necessary, except as a change in environment, for the mere sake of a change is often found to be of advantage to a student. The time is at hand in America when Eastern students may find as much in Western universities as Western students can get in the Eastern schools.

But the astonishing thing about it all is that all the people of a democratic State freely tax themselves to supply training to the very limits of human knowledge to whomsoever will come and take. The world has never seen that before. It affords at once the substantial hope and the confident promise of an enduring and beneficent future for the American Republic.

ANDREW S. DRAPER,
Commissioner of Education, State of New York.

Staten (stăt'n) Island, N. Y., in the southeastern part of the State, is separated from Long Island by The Narrows and New York Bay, from Manhattan Island by New York Bay, from New Jersey by Kill Von Kull, Newark Bay, Arthur Kill, and Staten Island Sound. It is about 14 miles long and five miles wide. The surface is somewhat hilly along the coast; in some parts there are bluffs. The island constituted the county of Richmond, and had a county government until 1898, when it became a part of New York city under the name of Borough of Richmond. The island is chiefly a residential suburb of the Borough of Manhattan, but in the interior are farm lands, and there is considerable manufacturing. Fort Wadsworth, on the east coast, at the entrance to The Narrows, is one of the most important fortifications in the United States. The borough is divided into five wards; but the villages which were incorporated before the island became part of New York retain their Federal post-office organizations independent of the New York post-office. Some of the largest post-offices are Port Richmond, New Brighton, Stapleton, Tompkinsville,

Digitized by Google

Saint George, Tottenville, and Rosebank. In 1900 (government census) there were 603 manufacturing establishments on the island, with a capital of $11,567,183. The number of employees in manufactories was 5,992, the average annual wage, $3,153,526; and the value of the products, $15,970,001. Pop. (1890) 51,693; (1900) 67,021; (1910) 88,064.

Staten (stăt'n or stä'tĕn) **Island**, South America, belonging to the archipelago off the southeast coast of Tierra del Fuego, and virtually a continuation of the same, extends for 38 miles from northeast to southwest between Capes Saint John and Saint Bartholomew, and is separated from Argentina by the Strait of Le Maire. It rises in Mount Buckland to a height of 3,000 feet; the peak is covered with snow, the slopes verdant in evergreens, shrubs, and plants. There is great humidity or rain at all times, and the temperature is even. The chief harbor, among several excellent ones, is Port Cook, on the northeastern coast. This island was formerly an important whaling station for the English.

States of the Church. See CHURCH, STATES OF THE.

States Evidence is a term applied to evidence in a criminal case, in the form of a confession of one who committed or participated in the commission of a crime, and to be admissible it must be freely and voluntarily made.

States-General, the name given in France till 1789 to the general assemblies of the deputies of the three orders of the nation, the clergy, nobility, and the third estate. When peers were present it was not as forming a separate body but as the representatives of their order. The right of convoking the states belonged to the king, to the regent, or the lieutenant-general of the kingdom. There was nothing fixed as to the number of electors or deputies, nor as to the conditions entitling one to vote or to be elected. The States-General were first convoked in 1302 by Philip the Fair, assumed to itself the title of National Assembly, and that of States-General was never afterward revived in France. See FRANCE.

The name of States-General is also given to the legislative assembly of the kingdom of the Netherlands, in which there are also provincial states for local government.

States or **State Rights**, in a federal government, the rights of the several States in their constitutional relations to the central or national government. In United States history the term has played a prominent part since the early years of the 19th century, and especially during the period immediately preceding the Civil War, when it represented the prevailing view in the Southern States regarding the relation of those States to the Union. Out of this view developed the doctrine of nullification and the attempts to put it in practice, and the doctrine of secession as put to practical test in the Civil War, the final issue of which made an end of the State-rights view in its former constitutional aspects. See CONFEDERATE STATES; GOVERNMENT; NULLIFICATION; UNITED STATES.

Statesville, stāts'vĭl, N. C., city, county-seat of Iredell County; on the Southern Railroad; about 43 miles north of Charlotte and 20 miles northwest of Salisbury. It is in an agricultural and stock-raising region in which there is also considerable corundum mining. Cotton, grain, and tobacco are cultivated extensively. The chief manufacturing establishments are cotton factories, tobacco stemmeries, flour and lumber mills. The trade is chiefly in grain and cotton and tobacco products. There are seven churches and public and private schools. The national bank has a capital of $50,000. Pop. (1910) 4,599.

Statham, stăt'am, **Henry Heathcote**, English architect: b. 11 Jan. 1839. He studied architecture in Liverpool and practised there for a time, but removed to London about 1870 and since 1883 has been editor of 'The Builder.' He has written much on both architecture and music, and was for many years musical critic to the 'Edinburgh Review.' He has published: 'Architecture for General Readers'; 'Modern Architecture'; 'Architecture Among the Poets'; 'My Thoughts on Music and Musicians'; 'Form and Design in Music.'

Statice, stăt'ĭ-sē, a genus of maritime or desert plants of the family *Plumbaginaceæ*, called sea-lavender, marsh rosemary, etc., and found chiefly in the northern hemisphere. They are usually perennials, with tufted, alternate leaves, sometimes becoming diminutive shrubs. The flowers are commonly borne in cymes or panicles, composed of one-sided spikes, and have scarious, membranous, funnel-shaped calyces, colored, but often of a different hue from that of the five long-clawed petals. The fruits are small astricles. Several species are cultivated, among them the Russian statice (*S. latifolia*), notable for its very thick, long, perennial root, which is used for tanning in its native country. It is a handsome border-plant, having a radical tuft of long leathery leaves, elliptical in shape, and very loose panicles of minute blue flowers sometimes measuring a yard across, and useful in bouquet-making on account of the delicate sprays. Certain species yield valuable remedies, and others are useful as fuel in the deserts of Afghanistan.

Statics. See MECHANICS.

Stationers' Hall, the name of the hall of the «Master and Keepers or Wardens and Commonalty of the Mystery or Art of the Stationers of the City of London.» The company was incorporated in 1557, and had till the passing of the Copyright Act in 1842 an absolute monopoly, as all printers were obliged to serve an apprenticeship to a member of the company, and every publication was required to be «Entered at Stationers' Hall.» This registration is no longer compulsory, but the practice of registering is still useful in making good claims of copyright. See COPYRIGHT.

Stations, in the Roman Catholic Church, the name given to the Wednesday and Friday fasts: Tertullian says that the name is derived from military usage: on those days the Christian stood on guard and «watched in prayer.» The word has another peculiar signification in the city of Rome; there certain of the churches are visited on stated days by clergy and people, and those churches are called Stations. But by the word stations are more usually understood the «Stations of the Cross,» a very popular devotional exercise which is in use throughout the

Digitized by Google

Catholic world. These stations are a series of 14 images or pictures ranged round the interior of a church or even along a public way, in which are represented 14 incidents in the life of Jesus on the day of his crucifixion, namely, Sentence of death pronounced by Pilate; Christ receiving the cross; his first fall; his meeting with his mother; the cross borne by Simon of Cyrene; Veronica wiping Christ's face with a handkerchief; his second fall; his words to the women of Jerusalem; his third fall; he is stripped of his garments; his crucifixion; he expires; taking the body down from the cross; the burial. The people move in procession from station to station, reciting prayers at each, and between stations chanting the Stabat Mater, one stanza at a time.

Statis'tics, is the investigation and exposition, by means of numerical data, of the actual condition of states and nations in regard to their internal organization and foreign relations; but the name is now very generally applied to tabular or other statements of numerical information, having no connection with politics. Even in the first narrower sense statistics is divided into many branches, according to the matter with which it deals. Thus there are statistics of territory, of population, soil and agriculture, industry and commerce; intellectual, moral, social, and religious statistics; statistics of administration, finance, and military and naval affairs. The collection of statistics may have the object merely of ascertaining numbers, as is often the case with statistics collected for purely administrative purposes; or it may be undertaken with the view of learning what happens on an average of a great number of cases, as is the case of insurance statistics; or its object may be to detect the causes of phenomena that appear in the consideration of a great number of individual cases — such phenomena, for example, as the decline of a certain trade, the prevalence of a certain disease, etc. In the first case the only chance of error is in the collection of the statistics; in the second case error may also arise from not obtaining statistics sufficiently comprehensive to give a real average and eliminate the effect of chance; and in the third case error may be due not only to the neglect to make a sufficient number of observations to ascertain the exact nature of the phenomena to be investigated, but also to the overlooking of some of the circumstances under which the statistics were collected. By such oversight precisely those circumstances may be left out of account which constitute the essential difference between cases in which the phenomena in question do, and cases in which they do not, occur. In all of these ways positive errors may be made in dealing with statistics; but what often renders statistics valueless, or greatly diminishes their value even when they lead to no positive error, is want of the scientific insight necessary to enable one to put the proper questions, or the impossibility of obtaining the statistical information that it is most desirable to possess.

After statistics have been collected, the next thing necessary is to arrange the material. The simplest and most usual method of arrangement is that of tabular statements; but this method is not always practicable, and must be replaced by or used along with that of written summaries. Sometimes other methods of recording statistics are applicable, which have the advantage of presenting the information in a clearer and more impressive manner. This is often done by the aid of diagrams consisting of parallel lines, showing the circumstances under which the statistics were collected, and curved lines showing the results; frequently also by variously colored, tinted, or shaded maps.

The name statistics was first used by a German of the name of Achenwall in 1749, but even before him authors had scientifically combined statistical materials, as Francesco Sansovino in Italy (1566); d'Avity in France (1621); Lucas de Linda in Holland (1655); Conring, Bose, and Beckmann and Gastel in Germany; and Salmon in England (1724). In recent years the science of statistics has occupied largely the attention of the public, and a vast array of statistical matter is now published.

Statius, stā'shĭ-ŭs, **Publius Papinius**, Roman poet: b. Naples 61 A.D.; d. 101 A.D. His principal productions are two epic poems — the 'Thebais,' in 12 books, treating of the war of the seven princes against Thebes; and the 'Achilleis,' in two books, relating the achievements of Achilles, and incidents in his life previous to the Trojan war. The latter is unfinished. The style of Statius is bombastic and affected, often exhibiting the art of the declaimer rather than that of the poet; but he attracted general admiration in his own time, and even some modern critics have considered him inferior only to Virgil. He wrote some shorter poems, called 'Silvæ,' which have been distributed into five books, and some of these compositions are eminently beautiful. A modern edition of the complete works of Statius is that of Queck (Leipsic 1854); and of the 'Silvæ,' the best are those of Markland (London 1728) and Sillig (Dresden 1827).

Stat'uary Hall, the popular name of the historic chamber formerly used by the House of Representatives at Washington, and now utilized for the preservation of the statues of historic Americans. In this chamber Madison was inaugurated President in 1809 and again in 1813, and here Monroe was inaugurated for his second term in 1821, and where Millard Fillmore took the oath of office as President on 10 July 1850, following the death of President Taylor. This is the hall in which Henry Clay presided as Speaker of the House in the old days. Here occurred the stormy debates incident to the War of 1812 and the war with Mexico and the preliminary struggles over the vexed question of slavery. Here Daniel Webster and later Abraham Lincoln sat as obscure congressmen, each before the day of his meridian fame. Here John Quincy Adams was chosen President in 1825 over Andrew Jackson and William H. Crawford, when the election was thrown into the House of Representatives.

By the terms of an Act of Congress approved by President Lincoln on 2 July 1864, the chamber was officially designated as a national statuary hall, and an invitation was extended to all the States to contribute statues to be set up therein. The act reads:

The President is hereby authorized to invite each and all the States to provide and furnish statues, in marble or bronze, not exceeding two in number for each State, of deceased persons who have been citizens thereof, and illustrious for their historic renown or from distinguished

Digitized by Google

civic or military services, such as each State shall deem worthy of this national commemoration; and when so furnished the same shall be placed in the old hall of the House of Representatives, in the Capitol of the United States, which is hereby set apart, or so much thereof as may be necessary, as a national statuary hall, for the purposes herein indicated.

Up to 1904 statues to the number of 27 have been contributed by 16 States. New York has contributed two in bronze — Robert R. Livingston, by E. D. Palmer, and George Clinton, by H. K. Brown. New Jersey has set up two — Richard Stockton, a signer of the Declaration of Independence, in marble, and Philip Kearny, a major-general in the Civil War, in bronze, both by H. K. Brown. Pennsylvania has furnished two in marble — Robert Fulton, the inventor of the steamboat, by Howard Roberts, and John P. Muhlenberg, of Revolutionary fame, by Blanche Nevin. Massachusetts is likewise represented by two in marble — John Winthrop, first governor of Massachusetts Bay Colony, by Richard S. Greenough, and Samuel Adams, the Revolutionary organizer, by Anne Whitney. Rhode Island has also supplied two works in marble — Roger Williams, by Franklin Simmons, and Nathaniel Greene, by H. K. Brown. Connecticut has sent two — Jonathan Trumbull, the first governor, Washington's "Brother Jonathan," and Roger Sherman, both by C. B. Ives. Vermont also has supplied two in marble — Ethan Allen, by Larkin C. Mead, and Jacob Collamer, an early Senator, by Preston Powers. New Hampshire has contributed two in marble — Daniel Webster, born in the Granite State, and John Stark, of Bennington fame. They were modeled by Carl Conrads after statues in bronze in the State House Park at Concord. The original Webster statue was by Ball; that of Stark was by Conrads. Maine, the remaining New England State, has presented a marble statue of her first governor, William King, by Franklin Simmons. Ohio has furnished two in marble — James A. Garfield and William Allen, a Buckeye governor, both the work of Niehaus. Missouri has likewise furnished two in marble, representing Thomas H. Benton and Francis P. Blair, both by Alexander Doyle. Indiana has contributed one, representing her war governor and Senator, Oliver P. Morton, in marble; Illinois one — James Shields, Senator and soldier, in bronze, by Leonard W. Volk; Michigan one — Lewis Cass, by Daniel C. French; Wisconsin one — Pere James Marquette, pioneer and missionary, by G. Trentenove; Virginia one, a plaster statue of George Washington, supposed to have been made from life by the celebrated French sculptor, Jean Antoine Houdon, and West Virginia one — John E. Kenna, Senator.

Statute, a law proceeding from the government of a state; a written law. Some ancient statutes in Europe are in the form of charters or ordinances, proceeding from the crown. Statutes are either public or private (in the latter case affecting an individual or a company); but the term is usually restricted to public acts of a general and permanent character. Statutes are said to be declaratory of the law as it stood before their passing; remedial, to correct defects in the common law; and penal, imposing prohibitions and penalties. The term statute is commonly applied to the acts of a legislative body consisting of representatives. In monarchies not having representative bodies, the laws of the sovereign are called edicts, decrees, ordinances, rescripts, etc. See LAW.

Staunton, stân'tôn, **Howard**, English Shakespearian editor and pre-eminent as a chess-player: b. England 1810; d. London 22 June 1874. He was educated at Oxford after leaving which he settled in London, and devoted himself to literary pursuits, and to chess, becoming the champion chess-player of his day. His first important publications were 'The Chess-player's Hand-book' (1847); 'Chess-player's Companion and Chess-player's Text-book' (1849); 'Chess Tournament' (1852); 'Chess Praxis' (1860). Before the appearance of the last work he had begun the publication of an edition of Shakespeare, 1857-60, which was generally considered by the Shakespearian scholars of the day to furnish the best text that had till then been published. Later studies were given to the world in a series of papers on 'Unsuspected Corruptions of Shakespeare's Text,' begun in the 'Athenæum' in October 1872, and continued to the time of his death. He published 'Great Schools of England' (1865), and from 1844 till his death edited the chess column in the 'Illustrated London News.' 'The Theory and Practice of Chess,' by Staunton and Wormald, appeared in 1876.

Staunton, Va., city, county-seat of Augusta County; on the Chesapeake & Ohio and on the Valley Branch of the Baltimore & Ohio railroads; about 40 miles northwest of Charlottesville and 55 miles north of Lynchburg. It was settled in 1745 by people from the northern part of Ireland. In 1802 it was incorporated and in 1871 it was chartered as a city. From its importance as a strategical point Staunton became the objective point of many campaigns of the Civil War, but was not occupied by the Union troops until 6 June 1864, when Gen. Hunter entered the place without opposition and, after destroying the railroad several miles east and west of the place, and burning much public property and many warehouses, marched toward Lynchburg. (See PIEDMONT, BATTLE OF.) It was again occupied by Gen. Sheridan's cavalry 2 March 1865, and the railroad and public property were again destroyed. (See WAYNESBOROUGH, BATTLE OF; McDOWELL, BATTLE OF; SHENANDOAH VALLEY, MILITARY OPERATIONS IN.) It is in an agricultural region and has considerable manufacturing interests. The chief manufacturing establishments are chemical works, canneries, foundry, and other industrial works connected with farming and farm products. The principal public buildings are the Western State Hospital for Lunatics, the Virginia School for the Deaf and Blind, 16 churches, and the schools. The educational institutions are the State school mentioned, the Mary Baldwin Seminary, Virginia Female Institute, Staunton Military Academy, two business colleges, two other private schools, and public and parish schools. The four banks have a combined capital of $600,000; the annual amount of business is about $30,000,000. The government is vested in a mayor and a council of 12 members, each of whom holds office two years. Pop. (1910) 10,604.

Staunton, a river of Virginia which has its rise in Montgomery County, and flows east across Roanoke County, reaching the Blue

Digitized by Google

Ridge, through which it breaks, forming picturesque scenery. The descent is rapid; it falls 1,000 feet in 20 miles. It unites with the Dan River at Clarksville, Mecklenburg County, to form the Roanoke; length, 200 miles.

Stau'rolite, Staurotide, or **Cross-stone,** a mineral very frequently found in cross-shaped, penetration twins, whence its name (from *stauros,* a cross; *lithos,* a stone). It crystallizes in the orthorhombic system, the simple crystals being short prisms. Besides the twins above mentioned other forms abound. The crystals are usually rough and of a dark reddish-brown to brownish-black color. Hardness 7 to 7.5; specific gravity, 3.65 to 3.75; lustre somewhat resinous. It is a silicate of aluminum, iron, and magnesium. It abounds in many of the crystalline schists, such as mica schist, argillaceous schist, and gneiss. Important occurrences are Monte Campione, Switzerland, and Fannin County, Georgia; there are scores of localities in New England and North Carolina. It occurs sparingly in Brazil and North Carolina in transparent fragments which yield gems remarkable for their green to reddish-brown pleochroism.

Stavanger, stä-väng'gĕr, Norway, capital of Stavanger County, a seaport on Bukken Fjord, 105 miles northwest of Christiansand. It has two excellent harbors with quays and docks, and is protected by islands. The Bay of Dusevik is a rendezvous for warships, and is visited more than any other port of Norway by merchant vessels. The principal buildings are the ancient Gothic cathedral, Saint Peter's Church, several schools, museum, hospital, and mechanics' institute. The chief articles of export are herrings, anchovies, lobsters, sheep, marble, torsks, oil, and hides. There are some manufactures of cloth and pottery, and distilleries, ship-building yards, a repairing slip, and foundries. Kjelland, the novelist, was born at Stavanger.

Stavesacre, a larkspur (*Delphinium staphisagria*), native to the Mediterranean region, whose seeds have been used medicinally since ancient times. It is a pubescent plant, about two feet high, with purplish flowers in terminal racemes. The seeds are grayish brown, reticulated with ridges, oily, and have an acrid and biting taste. They contain the poisonous principle delphinine, but were used as a purgative and emetic; being too powerful, their use at present is confined to an external remedy, in tincture, for rheumatism, and, in powder or ointment, are employed for killing parasitic vermin.

Stavropol, stäv'rō-poly, Russia, in the Caucasus, (1) capital of the government of Stavropol, on the Atchla, 307 miles southwest of Astrakhan. It is the seat of a Greek-Catholic bishop and is a well-built town. The schools include gymnasia for both sexes, and several town and industrial schools; there are also several libraries, and a people's palace. The manufactures comprise soap, leather, and flour-mills, and there is considerable trade in hides, tallow, and corn. The town was founded in 1776, and, on the commercial route between Russia and Persia, has flourished. Pop. about 47,000. (2) The government of Stavropol covers 23,398 square miles. The rainfall is scant, forests rare, the fauna and flora differ from other sections of the Caucasus, somewhat resembling Central Asia. The inhabitants include Armenians, Greeks, Poles, Russians, etc., about one third being nomadic. On the wide prairies agriculture is carried on, and for this purpose various machines and implements are manufactured, and the products form the exports. Interesting is the communal tillage of lands, for the reserve fund of grain. The main streams are the Kuma and tributaries, and in this section are the best lands. The Mantych is a lake-formed river, once a connecting link between the Black and Caspian seas. Near the Caspian are some unimportant salt lakes. Other small streams water the country at the west. The climate is characterized by sudden changes. Stavropol was early colonized but unsuccessfully, until the military colonies of Cossacks (1711) were established. After the emancipation of the serfs, immigration increased rapidly, and still grows.

Stawell, stä'ĕl, Australia, a town of Victoria, 176 miles by rail northwest of Melbourne. The chief buildings are the municipal offices, some churches, mechanics' institute, and theatre. The great quartz reefs of the Pleasant Creek gold-fields are extensively exploited, and large cyanide works are operated. Agriculture is an important industry, especially wheat, and vine-culture is carried on.

Stead, stĕd, **William Thomas,** English journalist: b. Embleton 5 July 1849; d. at sea 15 April 1912. His father was a Congregational clergyman. He became editor of the 'Northern Echo' 1871; assistant editor *Pall Mall Gazette,* 1880, and in January 1890 founded the 'Review of Reviews.' In July 1885 he published 'The Maiden Tribute to Modern Babylon.' For some of his acts in procuring evidence for this book he was arrested and imprisoned for three months. In 1893 he founded 'Borderland,' a magazine devoted to occult subjects. He wrote 'If Christ Came to Chicago'; 'The Pope and the New Era'; 'No Rent'; 'No Reduction'; 'Truth About Russia,' etc.

Steam. Steam is water in a gaseous state. It liquefies at a temperature of 100° C., or 212° F., under a pressure of one atmosphere at the sea-level, namely, 14.7 pounds per square inch. High pressure and low pressure steam once meant steam used at pressures above or below this point, but the terms have lost their significance. The standard of steam pressure in engines is constantly rising, and high or low pressure are terms understood to-day as of no permanent value. «Absolute steam pressure is the total pressure computed from the zero of an absolute vacuum, as distinguished from relative pressure at sea-level. Ordinary steam-gauges indicate pressure above that of the atmosphere. To this must be added the pressure of the atmosphere in order to obtain the absolute steam pressure.»

Saturated steam or wet steam is steam holding water in suspension mechanically, or steam in contact with water at the same temperature, which is the case at its condensing or boiling point.

«When the pressure exerted by the vapor which a space contains at a given temperature has reached the limiting value for that temperature, the space is said to be saturated with the vapor. When a space is saturated with vapor the pressure exerted by the vapor is also known as saturation pressure. If the volume

Digitized by Google

of a space which is saturated with vapor be reduced, some of the vapor is condensed to a liquid state, but the pressure remains the same.»

«If the volume of the space be increased, provided that it contains sufficient liquid, more water evaporates and the pressure exerted by the water vapor soon attains the same value as before the change of volume.»

«If the temperature of a space containing water, and its saturated vapor be raised, the saturation pressure of the vapor is increased; if on the other hand the temperature falls, some of the vapor is condensed, and the saturation pressure is less.»

Superheated steam or steam-gas is steam not in contact with water, heated until it resembles a perfect gas. Dry steam is steam without any admixture of water vapor held me-

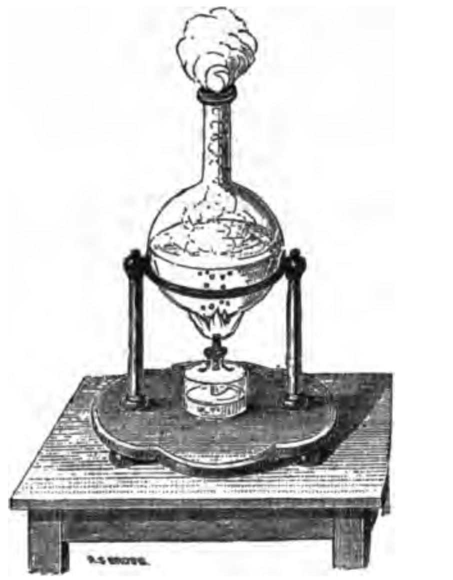


FIG. 1.

chanically in suspension. «Live steam» is steam which has performed no work, or rather which is available for the performance of work. Dead steam is steam which has performed work; more frequently it is called exhaust steam.

Vaporization.— When heat is applied to water, a point is reached at which the heat overcomes the cohesion and the pressure of the atmosphere, then the water passes into vapor. Evaporation takes place at the surface of the water. Its rapidity varies with the temperature and the pressure upon that surface. When a flask containing water (see Fig. 1) is placed over the flame of a lamp, the absorbed air is first driven off, then as the temperature of the water rises, the liquid molecules in contact with the bottom of the flask become so hot that the heat is able to overcome their cohesion, the pressure of the overlying water, and the pressure of the atmosphere above the water. At this temperature the change from a liquid to a gaseous state takes place beneath the surface, the gas escaping with ebullition.

The temperature at which steam is formed depends on the pressure under which it is generated. This relation has been determined with great care by Regnault. Upon these determinations the practical application of steam depends in large measure. The following table compiled from Rankine's reduction of Regnault's results gives the relations between pressure, volume, and total heat of steam for temperatures between 32° F. and 428° F.

«During the first stage of heating, all the heat sensibly goes into increasing the internal energy of the fluid. This is represented in the last column of the table under the heading ‹h.› During the second stage the heat taken in is known as latent heat of steam. The total heat of both stages is represented by the numbers in the fourth column of the table under the heading ‹H.› »

TABLE I.

Temperature	Pressure	Volume of one pound	Heat of Formation H.	h.
Degrees F.	Lbs. per sq. inch	Cub. ft.	Thermal units	Thermal units
32	0.085	3390	1091.8	0
41	0.122	2406	1094.5	9
50	0.173	1732	1097.3	18
59	0.241	1264	1100.0	27
68	0.333	935	1102.8	36
77	0.452	699	1105.5	45
86	0.607	529	1108.2	54
95	0.806	405	1111.0	63
104	1.06	313	1113.7	72
113	1.38	244	1116.5	81
122	1.78	192	1119.2	90.1
131	2.27	152.4	1121.9	99.1
140	2.88	122.0	1124.7	108.1
149	3.62	98.45	1127.4	117.1
158	4.51	80.02	1130.2	126.2
167	5.58	65.47	1132.9	135.2
176	6.87	53.92	1135.6	144.3
185	8.38	44.70	1138.4	153.3
194	10.16	37.26	1141.1	162.4
203	12.26	31.26	1143.9	171.4
212	14.70	26.36	1146.6	180.5
221	17.53	22.34	1149.3	189.6
230	20.80	19.03	1152.1	198.7
239	24.54	16.28	1154.8	207.8
248	28.83	14.00	1157.6	216.9
257	33.71	12.09	1160.3	226.
266	39.25	10.48	1163.1	235.2
275	45.49	9.124	1165.8	244.3
284	52.52	7.937	1168.6	253.5
293	64.40	6.992	1171.3	262.7
302	69.21	6.153	1174.1	271.9
311	79.03	5.433	1176.8	281.1
320	89.86	4.816	1179.5	290.3
329	101.9	4.280	1182.2	299.5
338	115.1	3.814	1185.0	308.7
347	129.8	3.410	1187.7	318.
356	145.8	3.057	1190.4	327.3
365	163.3	2.748	1193.2	336.6
374	182.4	2.476	1195.9	345.9
383	203.3	2.236	1198.6	352.2
392	225.9	2.025	1201.4	364.5
401	250.3	1.838	1204.1	373.9
410	276.9	1.672	1206.9	383.2
419	305.5	1.525	1209.6	392.6
428	336.3	1.393	1212.4	402.0

Dulong and Arago determined the tension of steam many years ago by means of the apparatus shown in Fig. 2.

In the figure (k) is a copper boiler, with a tube (a) containing a thermometer (t), which measures the temperature of the water, and its vapor. The tension of the steam is measured by a manometer (m). The steam passing through the tube (c), exerts a pressure on a column of water in the tube (i). This pressure is further transmitted to the mercury in the vessel (d), and thence to the manometer. By taking the manometer readings corresponding to each degree of the thermometer, a direct

Digitized by Google

measurement of tension was obtained up to a pressure of 24 atmospheres, and from this on by calculation. The following is a table of results:

TABLE II.

Temperature	Number of atmospheres	Temperature	Number of atmospheres	Temperature	Number of atmospheres	Temperature	Number of atmospheres
100.0°	1	170.8°	8	198.8°	15	217.9°	22
112.2	1½	175.8	9	201.9	16	220.3	23
120.6	2	180.3	10	204.9	17	222.5	24
133.9	3	184.5	11	207.7	18	224.7	25
144.0	4	188.4	12	210.4	19	226.8	26
152.2	5	192.1	13	213.0	20	228.9	27
159.2	6	195.5	14	215.5	21	230.9	28
165.3	7						

Regnault, 14 years later, devised a method by which the vapor of water could be measured at temperatures above or below boiling point. By this method the following tensions were obtained for temperatures ranging from 10° below to 101° above zero, of the Centigrade scale.

TABLE III.

Temperatures, degrees	Tensions in millimetres	Temperatures, degrees	Tensions in millimetres	Temperatures, degrees	Tensions in millimetres	Temperatures, degrees	Tensions in millimetres
−10	2.078	12	10.457	29	29.782	85	433.41
8	2.456	13	11.602	30	31.548	90	525.45
6	2.890	14	11.906	31	33.405	91	545.78
4	3.387	15	12.699	32	35.359	92	566.76
2	3.955	16	13.635	33	37.410	93	588.41
1	4.600	17	14.421	34	39.565	94	610.74
+1	4.940	18	15.357	35	41.827	95	633.78
2	5.302	19	16.346	40	54.906	96	657.54
3	5.687	20	17.391	45	71.391	97	682.03
4	6.097	21	18.495	50	91.982	98	707.26
5	6.534	22	19.659	55	117.478	98.5	720.15
6	6.998	23	20.888	60	148.791	99.0	733.21
7	7.492	24	22.184	65	186.945	99.5	746.50
8	8.017	25	23.550	70	233.093	100.0	760.00
9	8.574	26	24.998	75	288.517	100.5	773.71
10	9.165	27	26.505	80	354.643	101.0	787.63
11	9.792	28	28.101				

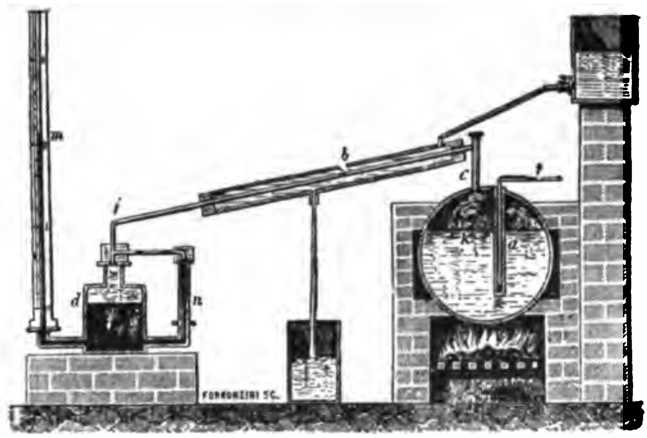


FIG. 2.

The Energy of Steam.— Water has the greatest specific heat of any known substance, except hydrogen. By this we mean that more heat enters into it, in order to raise its temperature one degree, than into any other substance, with the one exception mentioned. Its stored energy is 966.6 thermal units per pound, Fahrenheit scale. It is easily condensed, giving out this energy. These facts, together with its universal and abundant presence in large quantities, have rendered steam, up to this time, the best means for the generation of mechanical power. The process of changing steam into mechanical power may be briefly outlined as follows: If we start with water at 32° F. and apply heat, the temperature of the water will rise one degree for each thermal unit, but expansion does not begin until 38 to 40 degrees of temperature are reached. When 180½ units of heat have been absorbed the temperature of the water will be found to be 212° F. and its expansive force equal to 14.7 pounds to the square inch, or that of the atmosphere at sea-level. At this point the water is incapable of becoming any hotter under that pressure. The heat added, after that point is reached, is used in converting the water into steam, and 966.6 thermal units are required for each pound of water thus converted. This so-called latent heat is stored energy, to be given back again in mechanical work and heat, as the steam is condensed. If we enclose both water and steam in a boiler of suitable construction, and continue heating, part of the water will be vaporized, but being prevented by the envelope of steam from expanding, it crowds the available space, and the pressure upon the surface of the water is increased so that the heat now added increases temperature again. When we have added 1,182 total thermal units (including temperature and latent heat) the pressure, or energy of the steam will be equal to about 100 pounds to the square inch, and the temperature will have risen to 329° F. (see table I., columns 1, 2, and 4).

We have now to consider how this energy is transformed. When the steam in the cylinder of an engine performs work by pushing the piston against a resistance, that work robs the steam of a portion of its heat, hence the steam is condensed. Theoretically, it requires two and a half pounds of steam, saturated, to supply one horse-power of work each hour; but practically, from 5 to 25 times that amount is required to pass through an engine in order to secure this result.

This is due to the loss of the energy of the steam, in giving up its heat to the walls of the cylinder, and to the immense portion of the steam which acts only as backing. In the best quadruple engines of to-day less than one fifth of the energy of the steam is converted into actual work, and in the best non-condensing engines only one tenth. The waste is enormous, but the abundance of the supply in part compensates for it.

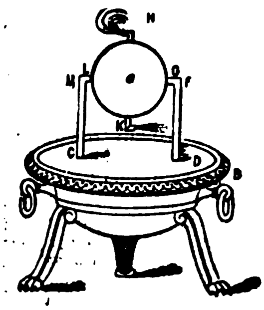
It is estimated that there is 4,000,000 horse-power of steam used in manufacturing in the United States, and that the total horse-power used on an average six hours a day, is not far from 120,000,000. This requires 150,000 tons of steam to be condensed daily. We may safely say that 11 times as much goes to waste, mak-

Digitized by Google

ing 1,800,000 tons of steam which passes through our engines daily. A large amount of steam is used, in addition to this, for heating purposes. Its value in this respect is due to its being able to carry more heat for a given weight than any other substance, and when it has given up its heat to drop out of the way, by condensation, and make way for a fresh supply. It is roughly estimated that the amount of steam used in the city of New York alone, for heating purposes, is 18,000,000 tons per year, and in the United States about 10 times as much.

It is pertinent to ask what becomes of it ultimately? Nature provides for its absorption in the air, and it is probable that large as it is, it forms but a small fraction of the moisture in the atmosphere. JOHN R. PADDOCK,
Member of the American Association for the Advancement of Science.

Steam and Steam-engines. Steam, the vapor of water, has special interest as the working substance of the steam-engine, the principal source of power for industrial purposes throughout the world, and hitherto, at least, throughout the history of modern industry. Steam is produced in the steam-boiler under constant pressure, that required for the steam-engine to which it is accessory and limited by the adjustment of the safety-valve. When the feed-water enters the boiler, it promptly passes into circulation and gradually assumes the temperature of the great mass of water of which it forms a part. This rise of temperature is by continuous accession of heat until, the temperature of the steam at the existing pressure being attained, its temperature becomes constant and the inflow of heat takes effect in vaporization, steam being produced in proportion to the heat received. Steam thus produced is said to be «saturated»; if containing no suspended water, as mist, it is «dry and saturated.» If, after separation from the water in the boiler, it passes through a «superheater» in which additional heat is imparted, it is said to be superheated, and, behaving as would a gas, it rises in temperature above that due the pressure for saturated steam and its excess of temperature is proportional, very nearly, to the quantity of heat absorbed.



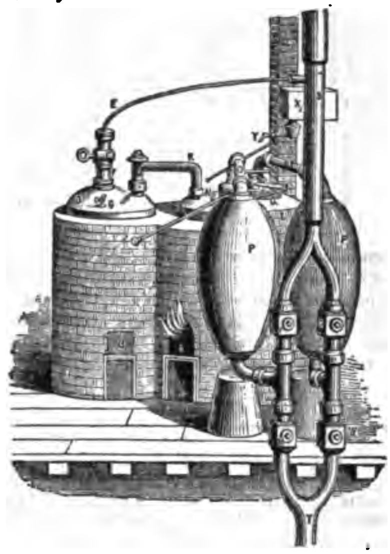
Hero's Steam-turbine (120 B.C.).— A B, steam boiler; C D, supports; *a*, revolving globe; H K, nozzles.

The existing definite relations between the temperature, pressure, and volume of saturated steam may be expressed with close approximation by simple formulas. Superheated steam may be regarded as a gas, if not too near the temperature of saturation, and these relations may be precisely expressed as with gases in general. The relation of the temperature of water to influx of heat is also definite.

The quantity of heat required to raise unit weight of water through a stated range of temperature, $T_2 - T_1$, is:

$$Q = C(T_2 - T_1)\,; \quad H = J(T_2 - T_1)\,;$$

where expressed in thermal or in dynamic units, Q being the thermal and H the dynamic measures, and C and J the thermal and the dynamic measures of the specific heat of the fluid. With water, $C = 1$ and $J = 778$ or 427, in British or metric measures, foot-pounds or kilogrammetres, respectively.



Savery's Engine (1702).— L, boiler; G, feed-vessel; P P, forcing vessels; S, rising main; T, suction.

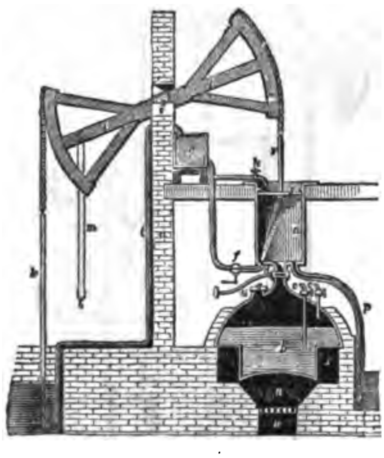
The relation of pressure to temperature of steam in contact with the water from which it is issuing was determined experimentally by Regnault, and the existing tables are founded upon his work. This relation has been expressed algebraically, in empirical and approximate formulas, by a number of authorities. Rankine's formula is $\log p = 6.1007 - \frac{2732}{T} - \frac{396945}{T^2}$, the units being pounds on the square inch and temperatures Fahrenheit on the absolute scale. Regnault's formula, with constants corrected by Moritz, is $\log p = A + Ba^t - Cb^t$; where for metric measures and for the scale between the freezing and boiling points, $A = 4.7393707$; $\log B = 8.1319907112 - 10$; $\log C = 0.6117407675$; $\log a = 0.006864937152$; $\log b = 9.996725536856 - 10$. Above the boiling point, Regnault gives $\log p = \mathrm{A} - Ba^x - Cb^x$, in which $\log a = 9.994049292 - 10$; $\log b = 9.998343862 - 10$; $\log A = 6.2640348$; $\log B = 0.1397743$; $\log C = 0.6924351$. Pressures are in millimetres of mercury; $x = t + 20$, metric.

«Steam-Tables» are given in all treatises on this subject, usually based upon Regnault, and supplemented with columns of data relating temperatures, volumes and pressures to the latent heats. Volumes were determined by Fairbairn and Tait, but are most exactly obtained by thermodynamic computation.

The production of steam in closed chambers involves the expansion of water against external and internal resistances with constant but slight change of volume and with increasing pressure upon the confining walls from minima

Digitized by Google

measured by imperfect vacua to maxima determined by the final temperatures of the steam produced. At the freezing point, this pressure is about 0.006 atmosphere; at the boiling point at the level of the sea, under one atmosphere pressure, the temperature becomes 212° F., 100° C. At pressures employed in the modern steam-engine, 6 to 10 and 15 atmospheres, the temperatures rise to from 320° to 356° and 390° F., 160° to 180° and 199° C. Meantime, the volumes of the vapor decrease, relatively to unit volume of water of maximum density, from 1646 at one atmosphere to 300 at 6, to 188 at 10, and to 125 at 15 atmospheres. This change demands the expenditure of energy sufficient to increase the rate of molecular vibration, storing the sensible heat producing the change of temperature and measured by the product of the range of temperature into the specific heat of the fluid, and an amount of energy measured by the product of the change of volume into the external and internal resistances to that expansion, measuring the external and internal, so-called "latent" heats. Sensible and total heats are usually measured from the freezing point. At ten atmospheres, for example, the heat measured, respectively, as sensible, as internal latent and as



Newcomen's Engine (1705).—B, boiler; *a*, steam-cylinder; *s r*, piston and rod; K, pump rod.

external latent and as total latent heats, have the relation, very nearly, of one to two and a half, to one fourth, to three and three fourths.

In the production of steam from water at temperatures below the boiling point, three stages may be observed. In the first, the water rises in temperature without sensible change of volume, and substantially all of the heat supplied remains in the form of sensible heat; in the second, the process is one of conversion of the water at the boiling point under the observed maximum pressure, from the liquid to the vaporous state at unchanging temperature, and all heat supplied is converted into the mechanical work of expanding the fluid against internal and external resistances from the volume of the liquid to that of the vapor; in the third, heat added produces "superheat" in raising the temperature above that of the water and steam at the temperature of saturation, converting the vapor into a gas and performing work of expansion if the volume is permitted to increase, or simply raising temperature, and without change from the form of sensible heat, if at constant volume.

The total heat is, in all cases, the sum of that supplied in enlarging the stock of sensible heat and that furnished to perform the work of expansion and thus becoming "latent." Latent heats have the measures: $l = 1091.7 - 0.695 (t - 32) - 0.000000103 (t - 39.1)^3$; $l_m = 606.5 - 0.695 t_m - 0.000000333 (t_m - 4)^3$; for British and metric measures respectively. The last term may usually be omitted. Total heats have the values, from the freezing point, $h = 1091.7 + 0.305 (t - 32)$ $h_m = 606.5 + 0.305 t_m$, in the two systems of measurement, respectively. The equivalents of these quantities of heat measure the amounts of mechanical energy expended in steam-making. Superheated steam has a specific heat at customary pressures of 0.4805, the pressure being constant, as is usual in superheating, and this quantity is added with each degree rise in temperature above that of saturation at the same pressure.

In all cases, the heat and the equivalent energy required are measured by the sum of that needed to produce the observed change of temperature and that required to perform the work of expansion against internal and external resistances as measured by the molecular cohesion and the pressure on the confining walls of the chamber in which the process takes place, whether the steam be saturated, moist, or superheated.

Algebraically, $H = H_1 + H_2 + pdv$; where H is the total heat, H_1 that present at the initiation of the change observed, H_2 that required to increase temperature and p and v the mean pressure and resultant change of volume; all energy being here measured in dynamic terms, foot-pounds or kilogrammetres.

Where the steam is wet, the heat and energy demanded in such changes are measured by the sum of that absorbed by the water present and that taken up by the steam. If x be the proportion of steam in the mixture, the latent heat becomes, per unit weight of mixture $l_x = xl$; the total heat will be $h_x = h + xl$; and the total volume will be very nearly xv, that of the fraction of steam present, v, h and l being the specific volume, total heat of water and latent heat of steam, per unit of weight, at the observed temperature.

For superheated steam, $pv = aT$; p, v and T being respectively, the pressure, specific volume and absolute temperature.

The heat stored in steam and available in the production of work by expansion, as in a steam-boiler explosion, was first computed by Airy, later more accurately by Rankine. The latter gave approximate expressions thus:

$$U = \frac{J(T - 212)^2}{T + 1134.4}; \quad U_m = \frac{J(T - 100)^2}{T + 648}$$

for British and metric measures, respectively; energy being expressed in foot-pounds and kilogrammetres and temperatures in Fahrenheit and centigrade. J is the mechanical equivalent of heat, in foot-pounds or in kilogrammetres.

The quantity of this stored energy is thus found to be enormous. At 10 atmospheres pressure, the energy thus liberated by one pound of water released from under that pressure would be above 10,000 foot-pounds, and one

Digitized by Google

pound of steam would give over 125,000 foot-pounds. The total energy stored in the steam-boiler is contained in a large weight of water and a comparatively insignificant quantity of steam; thus it happens that the danger to life and property when a boiler explodes is greatest where the boiler contains most water. In the common cylindrical fire-tube boiler, of 1,000 square feet heating surface, these quantities may be, respectively, 60,000,000 foot-pounds and 1,200,000, sufficient to raise the boiler itself a mile high, in the one case, and about 1,000 feet in the other. The locomotive often stores twice these amounts of energy in destructive form, and the larger water-tube boiler about two thirds as much as the standard fire-tube boiler, per unit of rated power.

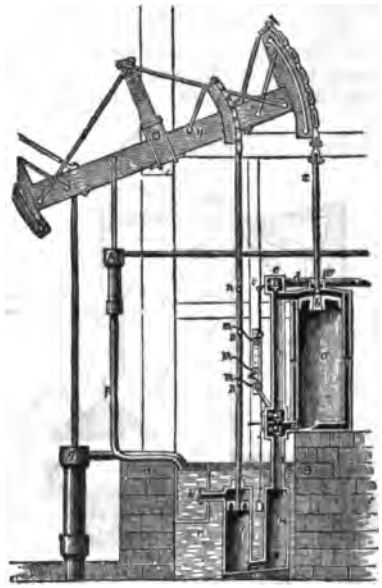
At usual pressures, the quantity of heat stored in steam, available and unavailable, is about the equivalent of two and a quarter pounds per horse-power-hour, or very nearly a kilogram. This would be the consumption of steam by an ideally perfect engine, operating with an efficiency of unity. The most economical steam-engines the world has produced approximate 25 per cent thermodynamic efficiency and demand about 10 pounds of steam per horse-power-hour, or nearly five kilograms.

Steam-engines and Boilers constitute the apparatus by means of which the stored heat-energy of fuel, transferred to water and steam, is transformed into mechanical work. This transformation of thermal into dynamic energy, this thermodynamic change, requires for its successful and economical conduct special forms of mechanism and is subject to a variety of wastes of serious aggregate amount, even with the most perfect of modern engines. The series of processes in the train between the fuel and the point of application of the useful energy with statement of the corresponding wastes and efficiencies are as follow; it being understood that an efficiency is the quotient of useful result divided by outgo producing it, the two being expressed in similar terms:— These efficiencies are those of

1. Combustion of fuel; ratio of heat set free to total heat latent in the fuel. This efficiency is usually not far from 0.90. Wastes due to incomplete combustion.
2. Heat-transfer from furnace to boiler; efficiency, as a rule, about 0.75, as measured by heat stored in the steam supplied. Wastes occurring mainly at the chimney.
3. Heat-transfer from boiler to engine with loss by conduction and radiation, *en route*. Efficiency of operation about 0.90 in small boilers and increasing to 0.95 or 0.98 in large sizes.
4. Heat-transformation into work at the engine with wastes by defective thermodynamic change and rejection of heat at the lower limit by conduction and radiation within and without the cylinder, variable with size, with mean temperature of steam and other conditions. Efficiencies for the ideal case usually approximate 0.25 with only thermodynamic wastes, and attain to 0.20 with successful constructions in the real case; the wastes including the thermodynamic and inevitable losses and the partly controllable extra-thermodynamic wastes.
5. The transfer of mechanical energy from cylinder to point of application. The wastes occur by friction and usually amount to about 0.10, as a minimum in condensing, and to 0.05 in non-condensing engines. Efficiency, 0.90 to 0.95.

The thermodynamic efficiency of the best steam-engines may be thus taken to be 0.25; the thermal efficiency at the engine, involving other wastes than thermodynamic, about 0.20; the total efficiency between steam-valve and fly-wheel about 0.18 and the efficiency of engine and boiler combined not far from 0.14; while the total efficiency of engine, boiler, and furnace, from coal-pile to engine-belt, may be about 0.125. In common constructions these efficiencies are much reduced and in many cases may be divided, by from two to four, the demand for fuel of good quality ranging from about one pound or half a kilogram in the best work to several times that amount per horse-power-hour, and for steam from ten pounds, about four and a half kilograms, to a multiple of that quantity. In some instances, as with many small boiler feed-pumps, 10 or even 20 times the minimum figures just given are reached, the wastes becoming enormous and the utilized energy of the fuel insignificant.

The "ideal case" is understood to be that purely thermodynamic operation which illustrates the conversion of thermal into dynamic energy where no other energies than thermal and dynamic are concerned, and where the change is effected in a machine which is not subject to wastes by conduction or radiation; an apparatus composed of perfectly non-conducting materials and perfectly constructed. In the "real case," the materials of construction are necessarily good conductors and good radiators of heat, and the wastes by conduction and radiation are often supplemented by leakage of steam as well as of heat. In the real case, the details of construction, adjustment and operation affect very greatly the resultant efficiency and the commercial rating of the engine. The study of the steam-engine thus comprehends the ideal, the purely thermodynamic, case and the real case with its various wastes, thermodynamic and extra-thermodynamic, as well as an investigation of the principles and practice in the design and construction of the real engine.

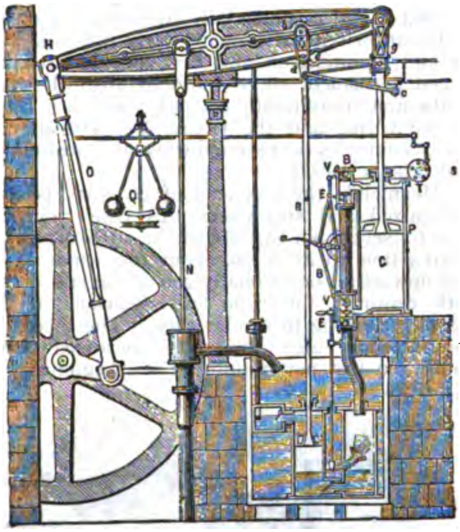


Watt's Engine (1774).—*a*, cylinder; *b*, piston; *x*, rod; *y*, beam; *i j*, air-pump and condenser; *m*, valve-gear.

Engines.— The power of steam and the employment of that fluid in various sorts of en-

Digitized by Google

gines have been familiar to mankind from an unknown and possibly prehistoric period. The earliest known record is that of Hero, who, in his 'Pneumatica,' of which the manuscript was produced at Alexandria, about 120 B.C., described a steam-turbine and several forms of steam-fountains and steam-boilers. So far as known, none of them had any useful application and they were simply toys or impracticable schemes. It is unknown, in fact, whether any



Watt's Double-acting Engine (1784).— C, cylinder; *b*, beam; O, connecting rod; Q s, governor and valve.

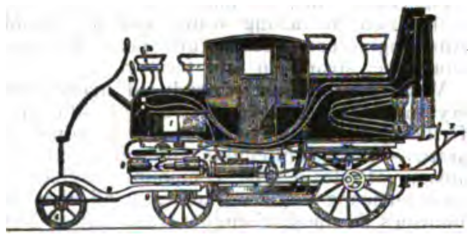
of them were constructed; although the drawings appear in some cases to be those of actual constructions.

Through the later centuries, up to the 17th, but little progress was made either in the acquirement of a knowledge of the properties of steam or in its application to useful purposes. Some forms of "æolipile," furnished a steam-jet for improving the draft of the chimney, apparatus for turning the spit and even more ambitious uses were either attempted or suggested; but, until Da Porta's treatise on pneumatics appeared in 1601, in which a steam-fountain was described, and the description in 1629 of an impulse steam-turbine, by Branca, no development took place of any real importance. It was not until the second Marquis of Worcester, Edward Somerset, constructed a steam-fountain (1650) and employed it in raising water from the moat to the top of the tower of Raglan Castle, and later erected another for similar purposes at Vauxhall, that the story of the evolution of the steam-engine really begins. Meantime the scientific men of the later centuries were acquiring some exact knowledge of the nature of steam, earlier confounded with other gases, and some familiarity with its latent powers.

Steam power first became an acknowledged industrial agent and useful as a prime mover when Savery, at the beginning of the 18th century (1698), made Worcester's steam-fountain practically applicable to the drainage of mines and the elevation of water for water-supply generally. This apparatus, which could not be properly called an engine, consisted of a pair of cylindrical or ellipsoidal "forcing vessels" which were alternately filled with water, by the production of a vacuum within the vessel, and emptied by the introduction of high-pressure steam from an adjacent boiler; the one being emptied while the other was filling and *vice versa*. This apparatus, introduced by Savery, improved and further made known by Desaguliers and by Smeaton, was known and in use before the year 1775 throughout the world where mining at considerable depths and in presence of water was carried on. The steam-fountain is still in use and is known as the "pulsometer."

Newcomen's steam-engine, the first steam-engine properly so termed, the first which consisted of a train of mechanism as distinguished from the Hero steam-fountain, which was a piece of apparatus without moving parts, was patented in 1705. It consisted of a steam-cylinder and piston, actuating a beam, above, from the opposite end of which was pendant the pump-rod operating the pumps in the shaft of the mine; it was always used as a steam pumping engine. Thomas Newcomen and his partner, John Calley, are thus to be credited with the invention and introduction of the modern steam-engine with all its essential elements as a pumping engine. It was the improvement of this engine by the addition of various valuable devices which gave James Watt his fame and fortune.

This earliest type was a condensing engine in which condensation was effected by means of a jet of water directed into the steam cylinder when the pressure on the under side of the piston was to be removed. The upper side was open to the air, there being no upper cylinder-head. The engine was thus operated by the atmospheric pressure, steam being held at about atmospheric pressure and only employed to secure a vacuum below the piston. The pressure of the atmosphere depressing the piston, the pump-rod on the opposite end of the beam was raised and the pump filled. With the fall of the pump-rod the water was forced out of the pump and raised to the upper level. The weight on the outer end of the beam always overbalanced the weight of the piston and attachments suffi-



Gurney's Steam-carriage (1828).

ciently to do the required work. This type of engine remained in use for a century, and old engines of Newcomen's time are still in existence. The type became known, later, as the Cornish engine, Watt's improvements having been meantime added. After Newcomen's death, the machine was improved in details by Desaguliers and by Smeaton, who considerably increased its economy by attaching wood to the piston and cylinder-head to prevent what has been called "cylinder condensation" by action of alternately heated and cooled metal in contact with the steam. This was probably the first rec-

Digitized by Google

ognition in construction of this important phenomenon.

The valves of this engine were at first worked by hand; but a boy, Humphrey Potter, is credited with having devised an automatic system, which, later in 1718, carefully designed and constructed in a workmanlike manner by Henry Beighton, a well-known engineer of that period, became the first automatic valve-motion.

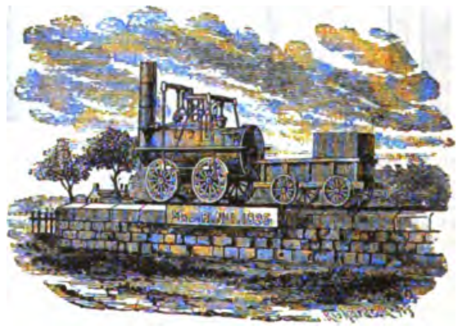
James Watt, introducing the needed improvements in the Newcomen engine, finally produced the modern types of «reciprocating» steam-engine. His first great improvement was the separate condenser, which permitted condensation to be effected without the introduction of water into the working cylinder and thus reduced very greatly the waste of steam by initial condensation. Watt first enunciated the principle: «Keep the cylinder, if possible, as hot as the steam that enters it.» The first step was this of removing the primary cause of refrigeration. The next was to surround the cylinder with a chamber containing steam at boiler pressure; thus introducing his second great invention, the «steam-jacket.» He next covered the upper end of the cylinder, excluding the cold air and supplying the place of the atmosphere and its pressure on the upper side of the piston by steam from the boiler, completing his scheme of keeping the cylinder as far as was practicable as hot as the entering steam.

The «double-acting engine» constituted the next and an easy step. With steam admitted at both ends of the cylinder, it was immediately evident that each might be utilized, alternately, in the performance of work and Watt soon adjusted his valve-gear and connections in such manner as to permit this alternation and produce a push and a pull on the piston-rod. This compelled a rigid connection between the piston and overhead beam, on the one end, and between the outer end of the beam and its work, now become that of rotating a shaft with crank and fly-wheel. Thus one improvement led to another and Watt's steam-engine ultimately became capable of supplying power to every imaginable kind of machine or work. The single-acting engine was, for many years after Watt's death, used in raising water and the double-acting engine continues to turn the shaft of mill, locomotive, steamship and factory.

Watt invented and introduced many accessory inventions and devices, as the attachment of the governor — already a well-known apparatus — the steam-engine «indicator,» the expansion of steam, the compound engine, the non-condensing engine, practically all that distinguishes the modern engine from that of Newcomen. These improvements raised the «duty» of the pumping engine, in the course of 25 years, from about 7,000,000 foot-pounds to 30,000,000, and, in the latest forms of Cornish engines, about 1850, to twice the last figure or more, reducing cost of steam-power enormously, and at the same time adapting the steam-engine to every requirement in the industries, giving to the world, in fact, its contemporary civilization. This cost in coal per horse-power-hour is reduced from the 35 pounds of Smeaton's time to one pound, as a minimum to-day, and the work of the world is performed by steam-engines, mainly, probably amounting to 150,000,000 horse-power and equivalent to the working power of several times the population of the globe, if employed in manual labor.

At the commencement of the 19th century, Trevethick and other able mechanics and inventors were seeking to construct locomotives, and complete success was achieved by George Stephenson in engines built from 1814 to 1833. The steamboat had been suggested by numerous writers and engineers, and, after many attempts, was made a practical success by John Fitch in the United States about 1785, by John Stevens in 1804-9 and commercially by Fulton, 1807-15. In Great Britain, after many early failures, Miller and Symmington and Bell, step by step, attained permanent success and by 1830, the date of the first transatlantic steamship voyages, those of the Cirius and the Great Western, all civilized countries were employing the steamboat. See STEAM VESSELS.

Meanwhile the elements of economy became recognized and steam-pressures rose from the two to seven pounds above the atmosphere of Watt's time to 25 or 30, about 1850, and to 100 and upward to occasionally 200 at the end of the 19th century; the ratio of expansion of the steam increasing in similar ratio. The speeds of engine-piston also gradually increased from about 100 feet per minute, at the beginning, to



Stephenson's Engine (1825).

600 and often to 1,000 at its end. The weights of engine and sizes for the usual powers meantime fell from 1,000 pounds or more per horse-power developed at the time of Watt, 500 about 1850 and to 250 in 1900 where weights were comparatively unimportant and, in special cases, where weight and volume required to be reduced to the smallest possible figures, as for torpedo-boats, to a fourth or a fifth, the last named quantity; while, in aeronautic work, ten pounds per actual horse-power has been reached and still lower figures are considered probable in the near future.

The compound, the triple and the quadruple expansion engine have largely displaced the simple engine of Watt; the first of these types having been introduced in Watt's time by Hornblower, Woolf and Falk and the second by Kirk about 1874; while the last-mentioned became standard with the rise of steam-pressures to about 15 atmospheres, about 1890. These complications are mainly the outcome of the endeavor to follow Watt in repressing the waste by cylinder condensation, reducing the proportion of heat-absorbing surface and the temperature-head producing flow of heat into the metal of the cylinder. Incidentally, the multiple-

Digitized by Google

cylinder engine gives a steadier rotation of the crank-shaft and a smoother action of the steam than the simple engine, and also reduces weight by lessening the maximum load upon the working parts, the range of pressure in each cylinder being reduced with this reduction of temperature-range.

This steady progression from the days of Watt to the end of the 19th century finally culminated in a retrogression to the simple form of the Hero engine, the steam-turbine, in which all the complication of the Watt-Newcomen engine is done away with and but one moving part performs every essential office, apart from condensation, and yet secures, in its best constructions, the economical results of the whole series of changes distinguishing the 19th century, with the added gain of reduced volume, weight and cost, both initial and operative. The turbine promises thus to provide power with maximum ultimate result in financial efficiency. Meantime, the gas-engine, after a similar period of development, is now rivaling the reciprocating steam-engine in many of its fields. The best steam-engines of both the standard types and the gas-engine are now capable of deriving large powers from substantially the same quantity of energy potential in fuel.

The Structure of the Steam-engine differs in detail according to place and purpose. The familiar forms may be thus classed: A primary classification as *condensing* and *non-condensing* distinguishes engines by their utilization or non-utilization of the vacuum. In the former class, condensation may be effected by surface or by jet-condensation; this distinction indicating a subordinate method of identification of a variation within the type. The usual classifications are based upon the essential features of structure, and these are ordinarily as follows:

1. According to the number of cylinders.
   (1) Single cylinder, simple engines.
   (2) Multiple-cylinder engines, "compound," etc.
2. With reference to the construction of cylinders:
   (1) Fixed cylinder.
   (2) Movable cylinder.
   In the first case, the engines are:
      (*a*) Vertical.
      (*b*) Horizontal.
      (*c*) Inclined.
   In the second case, they are:
      (*a*) Oscillating, vibrating, etc.
      (*b*) Rotary, steam-turbines.
3. With reference to the action of the steam:
   (1) Single-acting.
   (2) Double-acting.
4. With reference to the transmission of the steam-power:
   (1) Direct-acting.
   (2) Indirect-acting.
   And in the latter case either —
      (*a*) With balance lever, or beam.
      (*b*) Without lever or working beam, geared, etc.

The essential details of these engines are usually the same in all the forms in which the individual piece is found. A rod or a crank, a shaft or a valve, will commonly be found to have assumed a standard form, and the differences in engines is largely a difference in grouping. Since Watt, but few advances have been made in real invention, and the progress observed has been mainly one of refinement and adaptation. Frederick E. Sickels introduced a successful form of «drop cut-off»; Corliss, Greene and others invented improved valve-gears embodying the same general principles, and Porter and Allen, and others, successfully established the «high-speed» engine as a motor where rapid rotation of the prime mover facilitated transmission of power, as with electric generators and in rolling mills.

Similarly, the locomotive proposed by a number of earlier inventors, particularly by Trevethick, who constructed several, was successfully brought into use by George Stephenson and, to-day, in its many forms and uses, the engine in its essential details and distinguishing features is that of Stephenson, refined and adapted to high and to low speeds, to heavy and to light loads. A very noticeable feature of the later engines is the forward «truck» or «bogie,» devised by John B. Jervis, which, by permitting the forward wheels to swivel and the engine to rock upon the truck, accommodates the locomotive to sharp curves and irregular track.

In marine construction, a similar adaptation of the form and proportions of the engine to the special purpose in view gives rise to the types employed with side-wheel and screw, high powers and low, to the essential requirements in lightness and small bulk of torpedo-boat practice and the needs of transatlantic navigation and of that of the rivers of the United States. The substitution of surface condensation for condensation by the jet has been compelled in sea-going ships by the use of high-pressure steam and the impracticability of using sea-water in the boilers. The later forms of engine are thus refinements and adaptations of the earlier.

Meantime, in all directions, the steam-engine has come to be utilized in the production of very large powers, and its construction in very large units is found to be very frequently economically desirable. Stationary engines for mills, and especially for large power-stations supplying the energy applied in electric lighting or power distribution for electric railways, are built in sizes ranging from a few hundred horse-power to five and even ten thousand horse-power, and sometimes grouped into systems rating as high as 100,000. Marine engines are also constructed in these large sizes and powers, and as high as 50,000 horse-power may be needed for the latest and largest transatlantic steamers. The locomotive, in the time of Stephenson weighing, in the case of his first successful machines, four to six tons is now built of above 100 tons weight and capable of hauling loads of 5,000 tons at good speeds, on level rails. The steam pumping engine of the time of Newcomen and Watt had a capacity of a few hundred thousand gallons per day; it is now furnished in sizes up to 20,000,000 and 30,000,000; while its duty has risen from the comparatively insignificant figures of the times of the inventors to 150,000,000 and 160,000,000 foot-pounds per hundred pounds of fuel. The steam-turbine, for all these uses, may now be obtained in as large powers as the reciprocating engine and with substantially the same guaranteed duty. Its relatively high speed of rotation, ranging from 600 to 1,000 in the largest sizes, to 10,000 or more in the small, and its smooth rotation, make its use distinctively advantageous in electric services and its small weight and volume are peculiarly helpful to the marine engineer and naval constructor.

The Thermodynamics of the Steam-engine, the science of its ideal case, involves the funda-

Digitized by Google

mental principles of Energetics, and in particular the laws governing the transformation of energy from the form of heat to that of mechanical energy and *vice versa.* An all-comprehending law, of which the laws of energetics are in fact corollaries, the law of Existence, or of Persistence, is expressed thus: All that exists, whether matter or force or their resultant, energy, and in whatever form, is indestructible by finite power.

Matter may change its form and its chemical composition by rearrangement of its molecules or of its elementary atoms, but it cannot be destroyed; forces inhere and are persistent as characteristics of all matter and cannot be separated therefrom; energy, like matter, is constant in its total quantity in the universe and may be transferred and transformed, but cannot be extinguished. Transformation of energy, as of thermal into dynamic or mechanical, is simply the change of the kind of mass affected and consequent alteration of the kind of motion due to its action. A shot from a gun, stopped in its rapid flight by impact on the target, if not fractured, will exchange the thousands of foot-tons of mechanical energy sustaining its flight for precisely the same quantity of molecular motion and energy. Similarly, were a shot heated to a high temperature and then were all its molecules by some conceivable process of steering each into its path, made to take up simultaneously a definite rectilinear motion, it would become absolutely cold and would fly out into space with a dynamic mass-energy precisely equal and, in fact, with the identical energy at first displayed as molecular. The heat-engine is a device for bringing about such a change for industrial purposes.

The laws of energetics, as usually enunciated, are:

1. *The Law of Persistence, or of Conservation of Energy,* namely: Existing energy can never be annihilated; and the total energy, actual and potential, of any isolated system can never change.

This is evidently a corollary of that grander law, asserting the indestructibility of all the work of creation, which has already been enunciated.

2. *The Law of Dissipation, or of Degradation of Energy,* namely: All energy tends to diffuse itself throughout space, with a continual loss of intensity, with what seems, now, to be the inevitable result of complete and uniform dispersion throughout the universe, and consequently of entire loss of availability.

It is only by differences in the intensity of energy, and the consequent tendency to forcible dispersion, that it is possible to make it available in the production of work.

3. *The Law of Transformation of Energy,* namely: Energy may be transformed from one condition to another, or from any one kind or state to any other; changing from mass-energy to molecular energy of any kind, or from one form of molecular energy to another, with a definite quantivalence.

Thermodynamics, being a restricted energetic, in which only two energies, thermal and dynamic, are comprehended, its laws are, fundamentally, identical with the preceding and the enunciation just adopted is entirely accurate in this restricted science.

The Laws of Thermodynamics, in the special forms considered best for the purposes of the thermodynamist, are corollaries of the laws of energetics and of Newton's laws, which are a different method of expression of the same fundamental principles. They are usually stated thus:

1. *Thermal and Mechanical Energy are mutually interconvertible in the proportion of one British Thermal Unit for each 778 foot-pounds, or of one calorie for each 427 kilogrammetres of energy or of work.*

The mechanical equivalent of heat is the specific heat of water at its temperature of maximum density expressed in dynamic units, as foot-pounds or kilogrammetres.

The value of the mechanical equivalent of heat has been taken as first adopted by Joule, although recent and most carefully conducted investigations indicate a value higher, by perhaps one per cent, to be more accurate. Many existing tables, and much work done in this field to date, have, however, been based upon Joule's figure, 772 foot-pounds, 423 kilogrammetres. The figure, above given, 778 or 427, is now, however, generally accepted.

2. *The total of any single effect of any given quantity of heat acting in any thermodynamic operation is proportional to the total amount of heat-energy so acting.*

This principle is substantially that first accepted by Rankine as the second law. Actual energy of vibration is understood.

Thus, of the whole quantity of heat passing from the heater to the working substance, one part is always transmuted into mechanical work, or energy; while the remainder goes to the refrigerator, and the ratio of the one quantity to the other is perfectly definite.

Professor Wood expresses this law thus:

"If all the heat absorbed be at one temperature, and that rejected be at one lower temperature, then will the heat which is transmuted into work be to the entire heat absorbed in the same ratio as the difference between the absolute temperatures of source and refrigerator is to the absolute temperature of the source."

The second law finds important application simply in enabling us to ascertain the total quantity of work, external and internal, required to produce changes of volume and energy in fluids, like the vapors, in which we cannot measure directly the internal forces and internal work.

If the change of sensible heat be called dS, that of "latent" heat, dL, and of external work dU, then the first law of thermodynamics is expressed by the equations:

$$dH = dS + dL + dU, \quad \ldots \ldots \quad (A)$$

and

$$dH = dS + dW, \quad \ldots \ldots \quad (B)$$

$$dH = dE + dU, \quad \ldots \ldots \quad (C)$$

where, in the last two expressions, $dE = dS + dL$, and is the variation of energy, actual and potential; while $dW = dL + dU$, and is the total work done, externally and internally. These are primary and general equations.

The quantity E is often called the intrinsic energy of the substance; L is evidently a potential energy; while S is a form of molecular kinetic, or actual, energy, which may sometimes be regarded as also in a sense potential.

The above are completely general expressions of the *general fundamental equation of thermodynamics.*

Internal work or energy, positive or negative, is the work performed in changing the relative distances between molecules, atoms or corpuscles, or in causing variation of their relative velocities, and within the mass and out of reach of the human senses. In the fundamental equation, it is measured by dL.

External work is that performed by mass or molecule, by atom or corpuscle against outside resistances, as where steam expands, doing work upon a piston. As indicated by the above laws, it must do so by surrendering an equivalent quantity of heat-energy. This is dW.

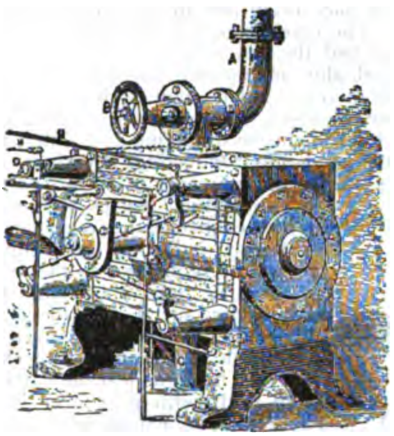
Heat-energy, thermal or dynamic, is of the same nature and may be measured in either thermal or dynamic units, foot-pounds and kilogrammetres, or in British or metric thermal units or "calories." One *B. T. U.,* expressed in thermal units, is 778 foot-pounds expressed in dynamic units; one metric unit, the calorie, is 3.96832 times as great as the British, or the *B. T. U.* is 0.251996 of the metric unit. The engineer often conducts his thermoydyamic investigations in dynamic terms; the physicist and the chemist employ the thermal; the one often uses British, the other always adopts the metric.

Digitized by Google

Where work is performed by an expanding fluid upon a moving piston, the total work,

$$U=(p_e+p_i)\,as;$$

where a is the piston-area, and s is the space traversed by the piston; mean pressures corresponding to the external and the internal work being p_e and p_i while $as=v$, the volume traversed.



Corliss Engine Valve-motion (1850).

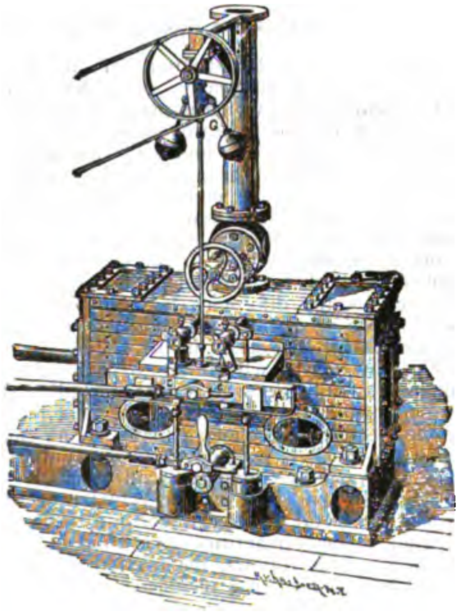
The Perfect Gas is a fluid within which no internal work is done with varying volumes and which may be defined by the equations, $pv=aT$; $pv/T=a$. In thermodynamic equations, the perfect gas has zero values of internal energy and work. T is absolute temperature, p and v the pressures and volumes at that temperature of unit mass.

Vapors are fluids in which the internal energy and work may be large, both absolutely and relatively, with changing volumes. Internal cohesive forces are often not only sensible but very great, the internal latent heat, which simply measures the internal work, when expanding water into vapor of one atmosphere pressure, as an example, is the equivalent of the work of elevation of the weight affected to a height of about 150 miles. These forces, however, as with the gases, do not prevent the free movement of molecules in any direction and to any extent; nor do they fix the volume and density of the substance.

Liquids are fluids in which the action of internal molecular forces gives stability of volume, but not of form, and the energies, internal and external, are thus limited to comparatively small ranges and to comparatively small values; while range and values are often enormously great when the liquid becomes vaporous, notwithstanding rapid diminution of molecular attractions.

Solids have stability, both of volume and of form; the ranges of internal forces and of energies are still more restricted than with liquids and their extent of action and their values are still less than in liquids. By accession of heat, all solids become at some definite point liquid, liquids become vapors and vapors, when "superheated," become gases. It is to be noted that, whenever a substance, of whatever class, alternately expands and contracts through a fixed range of volume, whatever its temperature or the pressure, precisely the same amount of internal energy is lost and gained by variation of volume against or with the constant effort of the internal forces.

Cycle is, thermodynamically, an operation in which a working substance passes through a series of changes of pressure, volume and temperature resulting in the final return of the substance to its initial physical state. In this operation, it is evident that the net change of internal energy is zero. This process is illustrated in heat-engines in which the working substance is confined within the working chamber and therein passes through repeated cycles with repetition of the kinematic cycle of the machine itself. Obviously, also, where a working fluid traverses a cycle, the presence or the absence of the quantity of internal energy becomes a matter of no importance when we seek only to determine the quantity of permanent thermodynamic transformation. The magnitude and effect of internal forces and energies have no influence upon the efficiency of transformation; but they have importance as affecting the relations of pressure, volume and temperature and the magnitude of the working cylinder and of the heat-engine itself. A steam, or other vapor, engine is vastly more compact than a gas-engine operating under similar thermal conditions, under similar limiting external pressures. The internal forces affecting water and its vapor are large and confine the substance, at any stated temperature, to small volume and give it a high density, relatively to its gas. In the highest boiler pressures now usual, these forces are about ten times the gauge pressure. At atmospheric external pressure, they amount to thirteen atmospheres. These pressures cannot be measured by any gauge, but may be readily computed with precision from easily ascertainable



Greene Engine (1855).

data; they are perfectly well known, as are the specific volumes of the fluid, which are very difficult, but not impossible, of direct measurement.

Digitized by Google

ıe has the advantage, in com-
e steam-engine, in its higher
ature range and consequent
ıamic efficiency.
atment of the thermodynamics
ıgine requires the use of the
tics, but the general principles
and the following will permit
o be understood:
ne is a thermodynamic system
ermal and dynamic energies are
ative. Its action is to transform
tion as possible of the heat sup-
hanical power and work. Each
from the boiler usually brings
lent of about 0.4 horse-power-
horse-power-hour is the ideal

uble-cylinder Pumping Engine (1878).

the heat-content of about 2.3
ıgram, nearly, of boiler steam,
part, which is precisely measured
the indicator diagram, is con-
ful work and an "efficiency" is
ed by the ratio of the useful to
ıergy in common units. Thus:
ıds of steam per hour are de-
rse-power developed, in the case
ficiency is 10 per cent; the heat
that furnished from the fuel and
ıe difference between the "total
ed-water at condenser tempera-
f the steam in the boiler.
nths which fails of utilization is
variety of wastes, including the
that portion of the heat reach-
ylinder and actually acting upon
h is not converted into indicated
by conduction and radiation ex-
ıe waste by the transfer of heat
tal of the cylinder and the work-
se quantities in a good example
s follows, the friction wastes of
elf being included:

rgy 100	Thermodynamic wastes.	70
	Internal thermal loss..	10
	External waste........	5
	Friction	2
	Useful work...........	13
		100

This corresponds, for the ideal case, to an efficiency of 0.20, nearly.

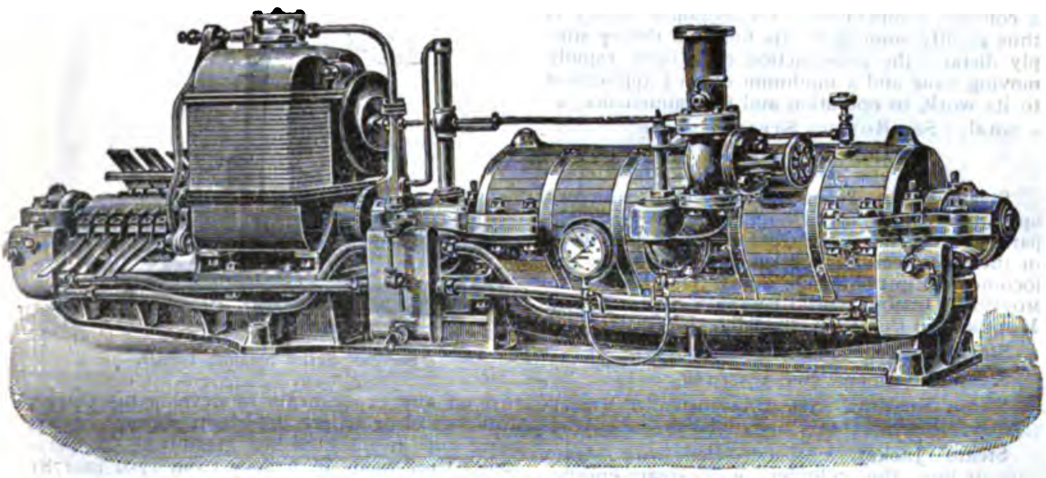
The external waste of the steam-engine is usually considered to be covered by an allowance of about one *B. T. U.* per square foot per hour per degree range of temperature, Fahrenheit, or about three calories per square metre, although, on exposed metal having a rough surface, it may attain two to three times these figures. The exterior of the cylinder is commonly lagged and the heads, if not thus covered, are polished, thus minimizing the waste. The total waste, on even small engines, has been found capable of being reduced to less than 3.5 per cent, total, inclusive of engine and boiler, by the use of good non-conducting coverings. This loss is often quite unimportant on large engines.

The internal wastes are produced by heat-exchanges between metal and steam, at induction and eduction; the steam giving heat to the metal at its entrance into the cylinder and robbing the metal at exhaust, thus transferring heat often in large quantities from the steam to the exhaust side, very much as leakage carries the steam itself with its charge of heat. The effect on efficiency is precisely that of leakage. In this action, the cylinder-heads and the sides of the piston, being exposed to the widest range of temperature and for the longest periods, are most fruitful of waste; the cylinder, proper, and especially its middle portion, wastes least. The total loss is a function of the temperature range, the time of exposure to transfer, and the quality of steam, and of the ratio of expansion which measures rudely the quantity of steam per unit weight of metal. In any one engine it may be stated, as a rough approximation, that the condensation is a constant quantity at all expansions. It may be treated as either a constant leakage or as a constant loss of work measurable by an equivalent back-pressure. A common value of this leakage may be taken, in pounds, as not far from 0.02 *B. T. U.*, per square foot of surface exposed at cut-off, per minute per Fahrenheit degree of temperature-range. As a fraction of the steam supplied, it is approximately proportional in any given engine to the square root of the ratio of expansion. With various types of engine, it ranges from 25 or 30 per cent, with simple engines of moderate size to 10 per cent, in multiple-cylinder engines of modern construction as a minimum. In steam pumps and very small engines, it may amount to more than the whole amount of steam taken in, for thermodynamic action. These machines, demanding 100, and even sometimes 150 or more pounds of steam per *h. p. hr.*, waste three fourths or more by "leakage" of heat. The "record-breaking" engines of large size and superior design demand as little as 10 to 12 pounds, approximating 200 *B. T. U.* per *h. p. hr.*

The velocity of heat-exchange in this manner is many times greater than in transfers across the boiler heating surfaces. It is the most rapid known form of condensation of steam, and is often 10 times as rapid as the production of steam in the boiler supplying it.

Digitized by Google

The conditions of maximum efficiency are mainly two: the reduction to the practicable minimum of the thermodynamic waste by increasing in all possible ways the area of the indicator diagram per unit of steam supplied, and by minimizing the wastes of heat between boiler and engine-piston. The first includes the increase of the initial pressure, with decrease of back-pressure and adjustment of the ratio of expansion of the steam to the range thus secured; the second involves reduction of conduction and radiation by use of suitable non-conducting coverings of heated surfaces, protection from cooling influences and reducing "cylinder condensation" by drying and superheating the steam, by increasing the speed of engine and by diminishing the heat-exchanges between metal and steam by fine finish of surfaces, and, where practicable, by interposition of non-conducting material, as was done by Smeaton and attempted by later inventors.



Parsons' Steam-turbine (1885–1895).

"Mechanical efficiency," the ratio of work transmitted from the piston to the point of useful application, ranges from 95 per cent in direct-acting engines as a maximum, to 85 per cent with the older non-condensing engines. It is made a maximum and friction reduced to a minimum by careful design, and especially by securing constant, complete and free lubrication; usually, in the best cases, by a circulatory flow of oil, flooding the bearings and returned by pumps to the source, through a filter, to be again distributed to the rubbing surfaces of the engine. The lost work is the less, as the pressures are higher within limits determined by the nature of the materials, as the lubricant is better adapted to its intended purpose, and as the flow is more liberal where reaching the rubbing parts. The highest values of the coefficient of friction are often ten and sometimes twenty times the lowest and the careful attention of the engineer to this detail is always well compensated.

The ultimate limit of economy in operation, with any class of engine, is fixed by financial considerations, and the principle involved in determining the limit may be thus expressed:—

That engine is most perfectly adapted to its place and purpose of which the type is such that no practicable substitution will permit the supply of the demanded power at lower total operative costs, including interest on first cost, a sinking fund to provide for replacement at the end of its period of use, and annual operating expense; and that size of engine is on the whole best, variation from which in the direction of either increased or lessened size will increase that total expense of operation. In the latter case, the gain by reduction of size will be more than compensated by the loss due to its reduced efficiency. The best engine is that which will give largest returns on the capital invested, adding most effectively during its life to the dividends obtainable from the "plant" of which it forms a part.

The adjustment of the ratio of expansion of the steam to the requirements of maximum efficiency is the vital problem of the designing engineer and the purchaser of the engine. In the ideal case of the purely thermodynamic machine, this ratio is that of the initial to the back-pressure, very nearly, and the terminal pressure on the expansion-line should coincide with the back-pressure. For maximum economy of fuel, this expansion ratio should be reduced in proportion, closely, to the loss by heat-wastes between boiler and piston. For maximum efficiency from the financial point of view, a still further reduction is required in proportion to the relation of the operating costs apart from those of steam-making to those of engine-operation proper. Thus, in the thermodynamic case, with initial and final pressures, respectively, 10 atmospheres and one, the ratio is reduced, often from about ten to seven or eight by initial condensation and minor wastes, and to six by adjustment to that value, departure from which, in either direction, would increase total costs of the horse-power-hour.

With condensing engines, the ideal ratio might be 40 or 50, while the ratio for maximum duty would be not above 20, and the best ratio, from the point of view of the treasurer, might be not above 12 or 15. The accuracy with which the designing and constructing engineer determines the adjustment for

Digitized by Google

maximum financial efficiency is a measure of his ability and skill and a gauge of his success in solving his problem. With each standard construction, experience usually enables the engineer to satisfactorily determine the proper solution of this problem.

The case of the steam-turbine exhibits here one of its essential peculiarities. The ratio of expansion is fixed by the conditions of its design, construction and operation and is necessarily the ratio of initial to back-pressure if properly constructed. The maximum efficiency of the turbine is obtained at its maximum power and it possesses the same inherent inflexibility as the hydraulic turbine, if of other than the «partial» class, in which latter case power is adjusted to load by varying the number of nozzles or supply-passages in action. It has the same possibilities of adaptation as has the hydraulic with, further, available recourse to intermittent supply, as with the Parsons turbine, a plan unavailable with the hydraulic machine, as an element of regulation. The steam-turbine, also, is not subject to internal condensation as all its elements, when in steady operation, maintain a constant temperature. Its economic theory is thus greatly simplified. Its financial theory simply dictates the construction of a light, rapidly moving vane and a minimum cost of application to its work, to operation and to maintenance, as a total. See ROTARY STEAM ENGINE.

R. H. THURSTON,
Cornell University.

Steam-Engine Terms. The Construction and operation of the various appliances and principal parts of a steam-engine are specifically described, in their connection with and application to the locomotive, in the article under the title, LOCOMOTIVE, DESIGN AND CONSTRUCTION OF THE MODERN, in this Encyclopædia.

Steam Gauge. — See STEAM-ENGINES.

Steam Hammer. See HAMMER.

Steam Heating. See HEATING AND VENTILATION.

Steam Jacket, a space filled with steam surrounding the cylinder of a steam-engine; from it heat passes into the cylinder and prevents the condensation of steam which would otherwise take place during expansion.

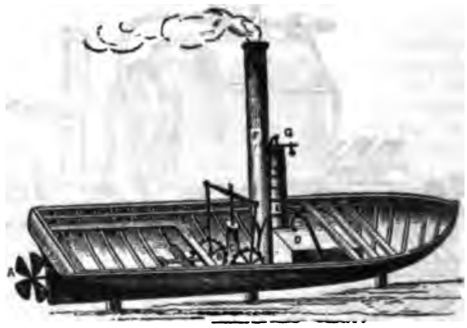
Steam Navigation. See STEAM VESSELS.

Steam-ships. See STEAM VESSELS.

Steam Turbine. See STEAM AND STEAM-ENGINE; TURBINE.

Steam Vessels. The paddle wheel was in use for the propulsion of a vessel long before the application of steam to navigation. In the war galleys of the ancient Egyptians and Romans there were wheels operated by hand power through a windlass; and in one of the Punic wars the Romans transferred an army to Sicily upon vessels moved by wheels that were operated by oxen. Prince Rupert, after retiring from his military life, had a boat constructed on the Thames River, prior to 1680, that was propelled by paddle wheels, which were driven by horse power. It is thus clear that some form of paddle wheel for propulsion was made use of long before the steam-engine was in service. The Marquis of Worcester had experimented with the steam-engine from about 1655. He died in 1667 leaving a manuscript in which he says: «By this I can make a vessel of as great burthen as the river can bear to go against the stream. . . . And this engine is applicable to any vessel or boat whatsoever, without therefore being made on purpose. . . . It roweth, it draweth, it driveth, to pass London Bridge, against the stream at low water.»

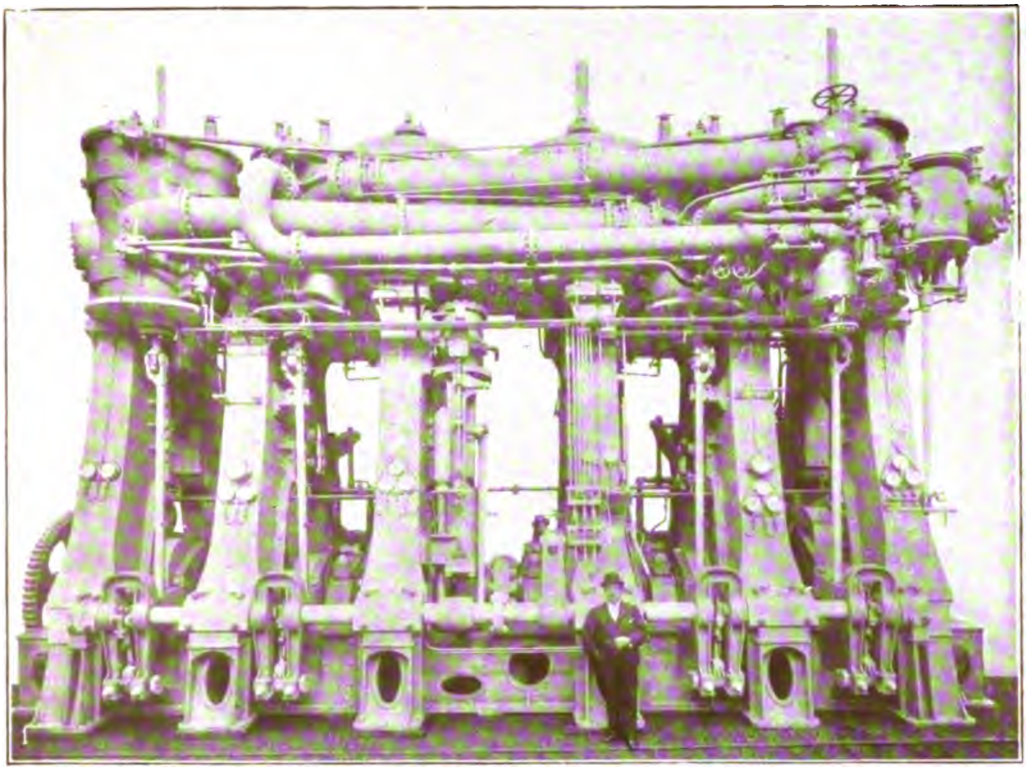
Early Steamboats.— The experiment narrated many years ago of Blasco de Garay in 1543 at Barcelona moving a vessel by steam power, has long since been looked upon with doubt. This was 100 years before the steam-engine was put to any practical use even in its crude form. Denis Papin and Thomas Savary had mentioned the application of steam to navigation about 1690, and the former is said to have applied it on a model at a later date. In 1736 Jonathan Hull of England obtained a patent upon what would be termed a stern wheel boat for towing purposes; but as the steam-engine at that time was not in a form to adapt it for a vessel, and as it is said he never made a model of his invention, nor carried on any experiments to develop his patent, it is not clear where the claim appears of his being the inventor of the steamboat. Experiments were made in France from 1759 to 1781 by Genevois and Perrier, when the Marquis de Jouffrey built on the river Saône a steamboat of 150 feet long by 15 feet wide, with which he made several experiments covering a period of over a year, but defects developed in the machinery so serious that caused the project to be abandoned. Patrick Miller of Scotland in 1788 had a double hull boat constructed 25 feet long and 7 feet broad, and fitted with a steam-engine, under the supervision of William Symington. It succeeded so well that he built the next year a larger double hull boat, and a trial was made on the Forth and Clyde Canal in the summer of 1789, when seven miles an hour was made. The boat, the wheels, and the engine were so ill proportioned to each other that the wheels were continually breaking, and the hull suffered so much from the strain imparted by the machinery as to be in danger of sinking. The trial was not considered to be a success, and the vessel was shortly after laid aside. It was now over 10 years before any further trials were made in Great Britain. It will be noted that John Fitch's experiments began in 1786, and Patrick Miller did not begin until some two years later. In 1802 Lord Dun-

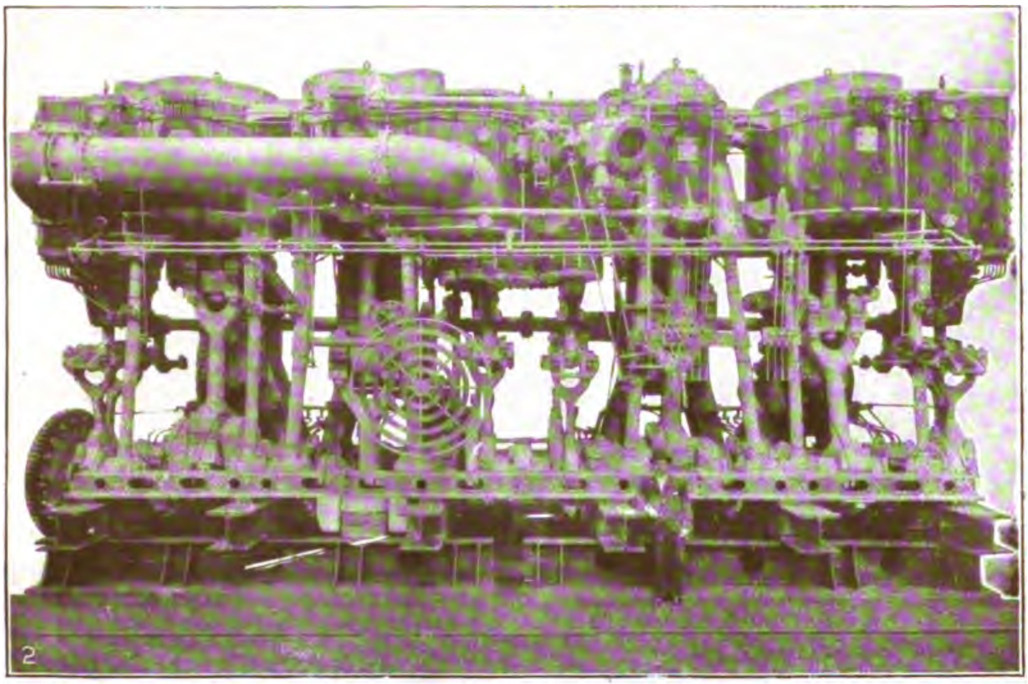


Stevens' Screw Steamer (1804).

Digitized by Google

TYPES OF MARINE ENGINES.





1. Engines of the Russian twin-screw Steamer "Smolensk."
2. Engines of H. M. S. "Lancaster."

Digitized by Google

Digitized by Google

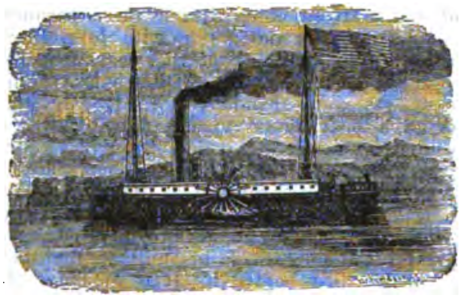
das, one of the proprietors of the Forth and Clyde Canal, had a stern wheel boat built to tow the canal boats on the canal, instead of towing with horses, and named Charlotte Dundas. The vessel was fitted with an engine of 22 inches cylinder by 4 feet stroke. The trial was made in March 1802 with two boats in tow, and 3½ miles per hour was made for a distance of nearly 20 miles. This was not thought to be satisfactory in every regard, so the vessel was put out of service. There was one feature of its use that was looked upon with apprehension and that was, it threatened the banks of the canal from the violent agitation of the water produced by the paddle wheel. It was now 10 years further before another steam vessel was built in Great Britain, and in the meantime Livingston and Fulton had constructed four steamboats for the Hudson River, and the Raritan for the New Jersey line, and the New Orleans for the western rivers; while John Stevens had built the Phenix and sent her to sea from New York to Philadelphia, Pa. This vessel was built in 1812 at Glasgow by John Wood for Henry Bell, and was the first successful steam vessel in Great Britain. The hull was 42 feet long by 11 feet beam and 5 feet 6 inches deep, and named Comet. By means of spur wheel gearing the power was transmitted to two pairs of paddles. As this arrangement proved to be unsatisfactory the vessel was fitted with a single pair of wheels, and the hull was lengthened to 60 feet, and the engine power increased. The speed of this vessel was originally five miles per hour. The first iron hull steam vessel built in Great Britain was in 1822 named the Aaron Manby, built at the Horsley Iron Works near Birmingham. The vessel was 166 feet long and 16 feet beam, and fitted with a 30 horse-power engine operating «Oldham's Revolving Oars that enter and leave the water edgewise.»

First American Steam Vessels.— The period when the first experiment with a steam vessel in the United States was made, so far as the mechanical side was concerned, was anything but inviting to those interested. There was not in the United States at the time one steam-engine in use, and it is doubtful if the first principles of its working were understood. The American people were comparatively poor at this time, having but a few years prior to this date returned to the peaceful pursuits of life after the long and costly War of the Revolution. After a few years the «steam mania» broke out, and the application of steam to navigation was under trial. To John Fitch of Connecticut must be given the credit for the first steamboat in the United States, imperfect as it was. He made his first trial on 22 Aug. 1787, but was not able to attain more than three miles an hour. This boat was propelled «by 12 oars or paddles five and a half feet, which work perpendicularly and are represented by the stroke of the paddle of a canoe.» Then in 1789 another boat was built that was fitted with more power, that developed on trial a rate of speed of eight miles an hour. These experiments were carried on by a company who furnished the capital for the enterprise, and not meeting with the success anticipated after three years' labor, refused to advance any more funds for the further prosecution of the enterprise, thus leaving Fitch to carry on his trials on his own account. This he did for a short time only, as he was unable to procure the means for the necessary changes in the vessel, and it was the financial condition that finally forced him to abandon the whole business. He made an experiment on the Collect Pond in New York in a common yawl boat, with both side wheels, and it is claimed with a sort of propeller in the stern of the boat. Nothing seems to have come from these later experiments. Fitch has been described as having been brought up from manhood as a watchmaker, and being fond of mechanics through the prosecution of his trade, he was continually experimenting along different lines, and at last drifted into the application of steam to navigation. He no doubt had a small knowledge of the steam-engine, but his peculiar disposition, with his intemperate habits, ever urged on by his impulses, kept him groping in the dark with his experiments, and subjected him to many disappointments and trials. There is no doubt he accomplished more in propelling his boats than some others have done at a later date. This man of misfortune, after spending years in poverty and distress, took up his residence at Bardstown, Ky., where he died about 1 July 1798. James Rumsey, a native of Maryland, and a strong competitor in the experimental stage of steam navigation with John Fitch, constructed in 1784 a boat that was propelled by cranks and a series of «setting poles.» This project was soon abandoned. In 1787 he constructed a boat about 50 feet long, that was propelled by admitting water through a trunk on the keelson of the vessel, and by means of a steam pump discharging it at the stern. This boat was never put to any practical use. Leaving the United States to his opponent, Rumsey sailed for London, where he built another vessel, but he died before its trial in 1793. To Oliver Evans of Pennsylvania must be given some credit for his trials in steam navigation. His early attempts in the application of steam were more directed to mill work and steam wagons, but it would appear that after Fitch began his trials Evans took up the same line of experiments. But the results obtained from his labors do not appear to have been very satisfactory. After he had constructed an engine in 1801 that gave fairly good results for manufacturing purposes, he was called on the next year to construct an engine of 9 inches cylinder by 36 inches stroke, for a boat of 80 feet long and 18 feet beam, built in Kentucky for Capt. James McKeever, U. S. N., and Louis Valcourt, and floated to New Orleans, La. Before the vessel was completed the river had fallen so much as to leave the vessel high and dry on shore. The engine and boiler were taken out and placed in a saw-mill, where they were in use until the mill was destroyed by fire. It would seem as though Oliver Evans by this unfortunate accident was robbed of the credit of having the first successful steamboat in operation nearly five years before the Clermont was placed on the Hudson River. In 1804 he constructed for the city of Philadelphia a machine for dredging the slips of the city. The machinery was fitted in place on a large scow, 30 feet long by 12 feet beam, and was driven by

Digitized by Google

a stern-wheel that was operated by a small steam-engine. It was driven down the Schuylkill River to the Delaware River, and up the latter river, in all some 14 or 15 miles.

Robert Fulton.— After the withdrawal of Fitch from the activities of steam navigation, and the death of Rumsey, there does not seem to have been that mania for the application of steam to navigation. It languished for a time, but not long: for Robert R. Livingston of New York was granted by the New York legislature the exclusive privilege of navigating the waters of the State with a vessel propelled by steam. Livingston was a man of wealth, and had a taste for mechanics. He was associated with John Stevens and Nicholas J. Roosevelt in experiments with a steamboat that year, but the results were unsatisfactory. Other trials were made the next year with another vessel, but with no better success. The grant by the State had now expired. Robert R. Livingston had been appointed minister to France, and while there had met Robert Fulton, who had been engaged in experiments with the application of steam to navigation, among other things, and in 1803 made a trial with a boat propelled by paddle wheels, which showed with

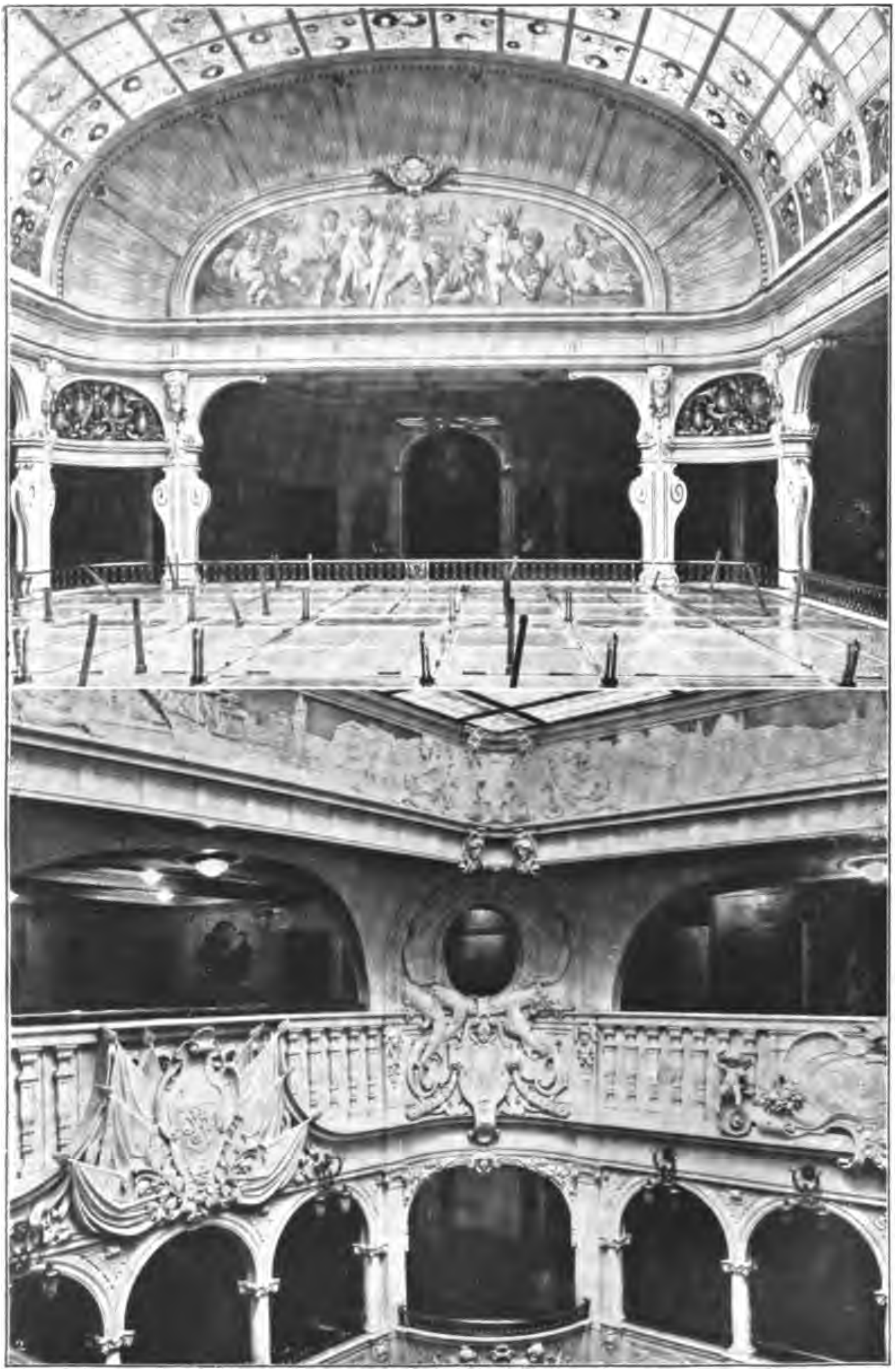


Fulton's Clermont (1807).

improvement in the engine they might look for better results. During the same year Livingston had the legislative privileges restored to him and Fulton, for two years, by the legislature. As those were not complied with, it was extended in 1807 for two years. John Stevens, then of New York, but later of Hoboken, N. J., was also a man of large means, with a mechanical turn of mind. His trials with the screw propeller began in 1802 and lasted until some time in 1806. He was doomed to disappointment in these trials like most of the early experimenters, for the want of proper tools and workmen to execute the work, but he met with some degree of success. This was the first practical application of the propeller to a vessel. Robert Fulton before leaving Europe in 1806 had parts of a steam-engine built to his order by Boulton & Watt of Birmingham, England, that were shipped to New York. He had the hull of a vessel constructed at New York in 1806–7, and the engine from Boulton & Watt was fitted on board. This vessel was named North River Steamboat of Clermont. It was 140 x 16 x 7 feet deep, and the engine having a bell crank motion, had a cylinder of 24 inches diameter and 4 feet stroke. Her trial trip from New York to Albany was commenced on 17 Aug. 1807. The vessel was enlarged during the following winter. The success of Robert Fulton dates from the time of the adoption of the side wheels as the propelling agency in his experiments. This means of propulsion had been on trial in this country prior to their use by Robert Fulton, and to these early experimenters should be given some credit for their trials. As early as 1789 Nathan Reed tried side wheels on a small boat driven by hand power at Danvers, Mass., and Samuel Morey of New Hampshire, in 1797 at Bordentown, N. J., had constructed a small steamboat that was "propelled by the means of two wheels, one on each side. The shaft ran across the boat, with the crank in the middle, worked from the beam of the engine." Then Nicholas J. Roosevelt, who had been interested in the early experiments with Livingston and Stevens, suggested the use of side wheels in one of the trials. But no. They were not at this time ready for so simple a means of propulsion. The latter undoubtedly knew what had been done in this line by those preceding them, and made use of the information when adopting the side wheels. As there was no part of the original Clermont that was an invention of Robert Fulton, though he obtained patents at a subsequent date on improvements, his theoretical knowledge of steam navigation and its adaptation to practical purposes was the cause of his success. He knew very nearly all that had been done in the way of experiments, and his ability lay in selecting those features that were of value and bringing them together so they were first seen in the Clermont. He must certainly have had mechanical ability of no mean order for that day to have accomplished so much at one stroke. The first complete American-built steamboat, both hull and machinery, was the Phenix, constructed in 1808 by John Stevens; and as Fulton held the exclusive privilege of New York waters for steam vessels, Stevens sent the vessel around to the Delaware River, leaving New York 8 June 1809, to form part of a line between New York and Philadelphia. About the same time the Raritan was built to run from New York to New Brunswick, N. J., to form the New York end of the New York and Philadelphia line. This vessel was run in the interest of the New York monopoly.

Early Ferry-boats.— Fulton and his associates, or the North River Steamboat Company, met much opposition in the prosecution of their enterprise, and it became so bold after a time in placing obstacles in the way, during the running of their vessels, that they were compelled to resort to the legislature of the State for a law to protect them in their lawful rights. There was one company who built two boats that were originally fitted with experimental engines, that were removed almost as soon as erected on board, and steam-engines and boilers substituted, in defiance of the rights of the Fulton company, to be operated in the State. After three years in the courts the vessels were delivered into the possession of the Fulton company, who broke them up. This exclusive privilege was the cause of a petition being laid before the New York legislature in 1814 by Aaron Ogden of New Jersey, who desired to run a steamboat on his ferry to Elizabethtown,

Digitized by Google



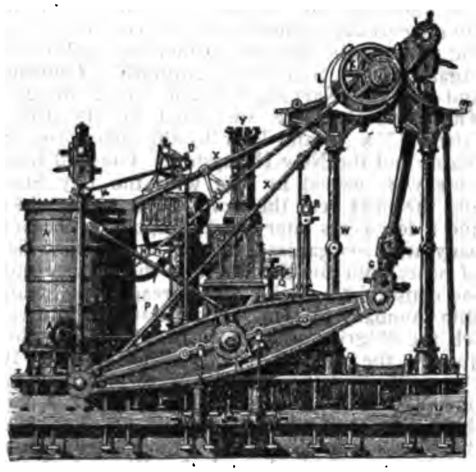
INTERIOR DECORATION OF A MODERN STEAMSHIP.

Digitized by Google

N. J., but was prevented by Livingston & Fulton. The matter was at length compromised so that Ogden ran his boat. He had a partner in his ferry property named Thomas Gibbons of Savannah, Ga., who opened an opposition line to Ogden, and it was on this route and line Cornelius Vanderbilt began his steamboat career. This opposition, commenced in 1818, was the cause of the lawsuit that was carried to the United States Supreme Court, where in 1824 a decree was entered against Ogden, thus breaking down the steamboat monopoly. The steam ferry-boat was first brought into use by Robert Fulton, on the Fulton ferry running from New York to Brooklyn in May 1814.

Hudson River Boats.— After the waters of the United States were thrown open to the free navigation of steamboats in 1824, the number of steam vessels increased on the Hudson River, as that was the most expeditious mode of travel from New York to Albany, as well as the best patronized channel of travel from the seaboard to the Western States, that were just then being opened to the settler. The new vessels were great improvements over the vessels of the North River Company, that now in many instances became tow-boats. For nearly 10 years later several lines were formed that were well backed financially for that period, until in 1832, when they were all consolidated. In 1835 the People's Line was opened with the Westchester and the Emerald. The most noted of the boats of this period were the Swallow and the Rochester, that were rivals on the New York and Albany route, and for several years were very often engaged in racing. This was the opening stage of that fierce rivalry between the lines on the river that was so well known for many years, when at times, so intense has been the competition, passengers have been transported the entire length of the navigable river free of cost of carriage. This lasted until 1852, when the steamboat law went into effect, which brought the operation of our steamboats under the United States law. And it was well it did even at that late date. The completion of the Hudson River Railroad in the latter part of 1851 had a great effect in diminishing the number of steamboats on the river. Since then the business on the river has been in the hands of companies that have been strong financially, and who have catered to the public travel with the better class of vessels suited to the service. The present day line was started in 1863 with the City of Albany, and was incorporated in 1879. The present boats of the line, the New York and the Albany, are the finest and the most speedy steamboats that have ever been on the river. The People's Line of night boats, or New Jersey Steamboat Company, had built in 1896 the Adirondack, that was a marked advance upon the form of the previous vessels of the line. Their first steel hull vessel, the C. W. Morse, is now nearing completion, and both these vessels are certainly a credit to the line. There have been at different periods several fine boats on the river to the lower landings, and possessed of high speed, that may be mentioned, such as the Mary Powell, the Thomas Powell, and the Alida.

Long Island Sound.— Communication by water on Long Island Sound dates back to 1813-14 when the Fulton was constructed for service from New York to New Haven, but on account of the War of 1812 and the activity of the British naval vessels off our coast at the time, it was deemed prudent to postpone the opening of the new line. It was not until 21 March 1815 that the vessel was placed on the route. In 1818 the Connecticut was brought out in the same interest, and run from New York to New Haven, while the Fulton was run from New Haven to Norwich, Conn., as it was considered unwise to run a boat on such a long route as from New York to Norwich, Conn., at that time. These vessels thus ran until prevented by the passage of the retaliatory law by Connecticut in 1822, when they ran to Providence, R. I. The United States was purchased in 1822 by New Haven parties and ran to Byram Cave, N. Y., and this service continued until the exclusive privilege of Fulton and others was declared unconstitutional, when the vessel was run direct from New York to New Haven. This was the beginning of the New Haven Steamboat Company. Other vessels followed of improved construction, and larger and better accommodations. They had their periods of opposition and low fares as on other important routes. The finest vessel that



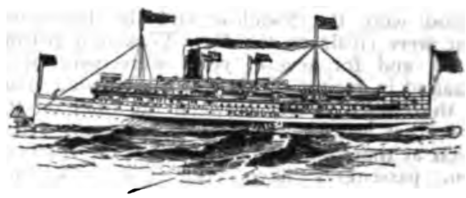
The Side-lever Engine (1849).

has thus far been on the line has been the Richard Peck, that has proved to be a vessel of high speed, and is well patronized by the traveling public. In 1899 a duplicate of this vessel, the Chester W. Chapin, was added to the line. Providence, R. I., was first served with a steamboat line in 1822. In the following six years three new steamboats were built for the line to New York, and during this period opposition began on the route. This had now become the most popular route from New York to the Eastern States. In 1835 Cornelius Vanderbilt placed the Lexington, then a new boat, on the route, and being one that developed in a short time higher speed than those on the old line, drew a greater portion of the passenger travel. The Boston and New York Transportation Company had the Boston, the Providence, and the Massachusetts in 1836. The Lexington was again on the route in 1836, and having made it lively for the old company, they had the Narragansett built, to be on even terms with the opposition, as they thought; but they were mistaken. The Lexington was purchased by the Transportation Company in 1838, as another opposition line with the J. W. Richmond had presented itself for public favor. The Lexington took fire while on a trip from New York to Stonington on 13 Jan. 1840 when off Eaton's Neck, Long Island. There were at least 150 persons on board, and all were lost except four. After 1845 the passenger service to Providence fell off to a great extent, and it was many years before it was resumed with a first-class passenger line. Stonington had become the popular route. The New Jersey Steam Navigation Company controlled the business of this route from 1840 to 1867, when they withdrew their boats from the service. A first-class passenger line was not resumed to Providence until 1877, when the Rhode Island and the Massachusetts were placed on the route by the Stonington Steamship Company, and then began the war of rates that lasted so long on Long Island Sound. These boats were followed by the Connecticut, and later by the Plymouth and others. The Joy line commenced running to Providence in 1899. After the Stonington line was closed up in 1867 there were no steamboats running to Stonington until January 1868, when the Stonington Railroad Company and others organized the Stonington Steamship Company, and ran the Narragansett and the Stonington. These vessels were succeeded by the Rhode Island (No. 3) and later by the two propellers Maine and the New Hampshire. The Fall River Line was opened in 1847 with the Bay State, and the next year the Empire State was added, and a few years later the Metropolis. The company was reorganized in 1863 and a new fleet of boats built for the line that did service until the consolidation with the Narragansett Steamship Company in 1874. Their first iron hull vessel, the Pilgrim, was added in 1883, and subsequently the floating palaces, the Puritan, the Plymouth, and the Priscilla were placed on the line. To New London and Norwich, Conn., there were several lines run up to 1860, when the Norwich & New York Transportation Company was organized, and the City of Boston and the City of New York were built. A few years later three smaller passenger and freight boats were built. In 1881 their first iron hull steamboat, City of Worcester, was placed in service, and in 1894 the steel hull twin-screw propeller City of Lowell was added to the line. This vessel has proved to be one of high speed.

Lake Steamers.— Steam navigation on the Great Lakes dates from the year 1818 when the Walk-in-the-Water was built to run on Lake Erie. The most radical departure in steamboat design and construction on the Lakes was in the building of the Great Western in 1838, by the adding of the upper cabin with staterooms, and converting the lower cabins into steerage quarters and freight compartments. There were several fine and large side wheel passenger boats built after 1845, after the general style of the Long Island Sound boats, up to 1856. The extension of the railroads along the shore of Lake Erie soon made their business unprofitable. Since 1880 there have been several large iron or steel hull passenger boats built to run from Buffalo and Cleveland to Detroit, and fitted with large engine power, that have proved themselves to be vessels of very high speed. Lake Ontario had its first steam vessel in the Lake Ontario built in 1816. There were several lines of beam-engine boats on the lake up to 1860, when the railroads, having absorbed the greater part of the business, several of the vessels were brought to the coast by running the rapids of the St. Lawrence River.

Coast of Maine Steamboats.—The coast of Maine was first visited by a steam vessel in 1823. There were many vessels running from Boston, Mass., to Portland, Maine, and the coast towns up to 1845, when the Sanford line began operations. The Portland Steam Packet Company began their operations in 1843. The iron hull propeller Bangor, running from Boston to Bangor, Maine, began its service in 1845. The International Steamship Company, running from Boston to Saint John, N. B., began operations in 1859. All the lines running from Boston to the coast of Maine were consolidated in November 1901.

Western River Steamboats.— The first steamboat constructed for the Western rivers was the New Orleans, built at Pittsburg, Pa., in 1811 under the supervision of Nicholas J. Roosevelt for Livingston and Fulton. Several vessels were constructed for these waters dur-



River Steamer (1895).

ing the next decade, but of a different form of hull and type of engine, several of them being more like those of a later date. The conditions under which the steamboats on the Western rivers are operated are so different from those on other rivers of the United States, that they are required in design to conform more closely to the surrounding conditions. The shallowness of the channel makes it necessary for the hulls of these vessels to be of great length and width in proportion to the depth of hull. The engines are all poppet valves, worked by levers, with the cylinders set horizontally on wooden frames, generally. The boilers are usually plain cylinder with two flues each. They are worked non-condensing under a pressure of 100 to 125 pounds to the square inch. They are usually fitted with side wheels, but of late years the stern-wheel boat has been favored for some service. There were a few compound engines in boats on the rivers several years ago, which type of engine appears to have been taken up again on the Western rivers very recently. Before the railroads in the Western States became so numerous, the passenger and freight business in that section of the country was largely carried on by the steamboats, and at that time there were many fine and fast steamboats on the Mississippi and the Ohio rivers, and a few of large dimensions. There was in

Digitized by Google

1852 the Eclipse of 363 feet long with two engines of 36 inches by 11 feet stroke each. The J. M. White of 1844 of 250 feet long, with two engines of 30 inches by 10 feet stroke each. Then at a later date the Grand Republic of 1876 of 350 feet long with two engines of compound type. The J. M. White of 1878 was 321 feet long with two engines 43 inches by 11 feet stroke each, and water wheels 45 feet diameter and 18 feet 6 inches face. The famous race of the Natchez and Robert E. Lee on the Mississippi River began on the afternoon of 30 June 1870 from New Orleans, and ended at Saint Louis on the morning of 4 July. The latter made the 1,218 miles in 3 days 18 hours and 30 minutes. The Natchez had run into a fog and grounded about 300 miles below Saint Louis that delayed her about six hours.

Ocean Steamships.— There have been a few attempts made to dispute the claim of the Savannah as the pioneer steamship of the Atlantic Ocean, but when these attempts have been closely examined it still leaves the American vessel at the head of the list. She was constructed at New York in 1818 by Francis Fickett as a sailing packet originally, but an engine and boiler were fitted before being placed in service. She was owned by parties at Savannah, Ga. On 24 May 1819 she left Savannah for Liverpool, England, which port was reached in 27 days, 80 hours of which time she was operated by steam power. On 29 September she started on her return to the United States, stopping at a few of the Baltic ports, and arrived at Savannah 30 November. Subsequently her machinery was removed and the hull converted to a sailing vessel, and run between New York and Savannah, Ga., until driven ashore on Great South Beach on Long Island, 5 Nov. 1821, during a gale, where she became a total loss. There was a long interval of time before another American steamship crossed the Atlantic Ocean, but during that period much knowledge had been gained of steam navigation that was of use in constructing ocean steamers. The Ocean Steamship Company in 1847 had the Washington and the Herman built for a line from New York to Bremen, they having obtained a contract to carry the United States mail for 10 years. In 1849 the New York and Havre Steam Navigation Company obtained a contract to carry the United States mail to Havre, and during the same year had the Franklin and the Humboldt constructed for the line. The latter vessel having been lost in 1853, and the former in 1854, the company ran the line with chartered vessels until the Arago and the Fulton were built and placed on the line in 1855. This line was well managed and received more American patronage than any other running to the same ports. These vessels ran until the opening of the Civil War in 1861. The next line of American ocean steamships was the Collins line, organized about 1847 as the New York and Liverpool United States Mail Steamship Company. The Atlantic and the Pacific were built in 1849, and the next year the Baltic and the Arctic were constructed for them at New York. The general dimensions of these vessels were each 277 feet long, 45 feet beam, and 24 feet depth of hold. Their motive power was a pair of «side lever» engines, the first two vessels built having cylinders 95 inches by 9 feet stroke, while the others were larger. The line started under a contract to carry the mail for $385,000 per annum, which was subsequently increased to $858,000: yet with this large mail pay, or subsidy, just as it is viewed, and a large share of the passenger travel and freight, it failed to be a paying line. The rivalry existing with the Cunard line at this time was very great, and the expenses of operation in making record time voyages made a heavy drain upon the finances of the company. There were also commercial and political interests that were antagonistic to the company, so that by 1857 Congress had cut down the appropriation for mail pay to less than the original amount; and as the line could not be operated successfully under these conditions the last vessel was withdrawn from the route in January 1858. Congress virtually «froze out» the company. The Adriatic was added to the fleet in 1857, and made but one voyage in the line. The remaining vessels afterward passed into other hands. The Arctic was lost by collision off Cape Race on 27 Sept. 1854; and the Pacific sailed from Liverpool on 23 Sept. 1856 and was never heard from afterward. The Atlantic was broken up in September 1871; and the Baltic was broken up about 1880, having for some time been run as a sailing vessel, her machinery having been removed. Cornelius Vanderbilt in 1855 began the operation of a line of steamships to Southampton and Havre with the North Star and the Ariel, and during the next year ran to Bremen. At this time he had built the Vanderbilt, his largest ocean steamship, that ran with some one of his large fleet of ocean steamships, to either Bremen or Havre until the opening of the Civil War. There were a few attempts made after 1865 to build up an American transatlantic line from New York, but they all ended in failures. It was also tried from Boston by the American Steamship Company, who had in 1866–7 the Erie and the Ontario built. The latter vessel made one voyage and returned, when laid up: while the former never made a voyage in the line.

The American Liners.— In 1871 the American Line, controlled by the Pennsylvania Railroad Company, was organized to run a line of steamships from Philadelphia, Pa., to Liverpool. It will be noted that this was at the beginning of the period when iron shipbuilding in the United States began to increase, and the compound marine engine was coming into favor. The company had built in 1873–4 the Pennsylvania, Ohio, Indiana, and Illinois. These proved to be good, staunch, and serviceable vessels for the line, though only of average speed under good conditions. They subsequently passed into the hands of the International Navigation Company, which absorbed the Inman line in 1886. The present American line is the result of an Act of Congress of 1892, providing with other conditions that certain foreign built steamships should receive American register on condition that steamships of corresponding tonnage were built in the United States. This led to the City of Paris and the City of New York receiving American register in 1893, and their names being then abbreviated to Paris and New York. Contracts were then made

Digitized by Google

with the William Cramp Ship and Engine Building Company for the Saint Paul and the Saint Louis, they having the first quadruple expansion engines built in the United States for the Atlantic service. These vessels ran to Southampton and Cherbourg. They are elegantly fitted and furnished in their passenger accommodations, are well patronized by the American traveling public, and have shown on more than one occasion that they are possessed of more than average high speed. In January 1903 the American and Red Star lines were consolidated with four British lines as the International Mercantile Marine Company.

Coastwise Steamships.—The Robert Fulton, built in 1819, was the pioneer in the coastwise trade with steam vessels, and ran between New York and the island of Cuba from 1820 to 1825, when sold to the Brazilian government. There were no steam vessels running coastwise from the latter date till 1832, when a small steamboat named the David Brown was refitted and run from New York to Charleston, S. C. In the next six years there were five larger vessels built for the same route, but of the same general type of vessel. After the loss of one of these vessels in 1837, public confidence in their safety became so shaken that they no longer found profitable employment on the route, and in a short time were withdrawn. The first steamships to be employed along our coast were those built in 1846–7 to run between New York and Charleston, S. C., the Southerner and the Northerner. These vessels were the pioneers of the many steam vessels that were built in a few years to run on lines between the Atlantic ports. The largest development of our early ocean steam marine began with the discovery of gold in California. During the Civil War these coastwise lines of side wheel steamships were discontinued. Then they were opened again and gradually fell into financially strong hands. Most of them after 1870 began the construction of iron hull vessels with compound propeller engines, and by 1880 had laid aside the wooden hull vessels with the expensive beam-engine, or the simple condensing propeller engine, so that at the present time we find a fine fleet of large vessels running from all our principal ports on the coast, that are operated at a much less cost for same size of vessel than those in the same service 30 years or more ago.

Whalebacks.— These vessels have a main deck rounded over, and resemble the back of a whale. They are for use in rough water, the waves passing completely over them without resistance or injury. The first one was built for a Baltimore company about 1860. Such vessels are now used as grain carriers on the Great Lakes; and more recently as passenger vessels. Their average speed is nearly 20 miles per hour.

Double Screw Ferry-boats.— This type of vessel, having a screw or screws at opposite ends of the vessel, is for ferry service of comparatively recent date, although double-screw steam vessels were built in this country many years ago. These vessels must not be confused with a twin-screw vessel having two screws at the stern of a vessel. The pioneer of the later development was the Bergen, built in 1888 for the Hoboken ferry, having a triple-expansion engine. Since then this type of ferry-boat has been growing in public favor until at this time it appears to be driving the old-fashioned side-wheeler out of use.

Screw Propellers.—After John Steven's experiments with the screw propeller in 1802 to 1806, there was nothing done in this country to practically demonstrate the value of the screw until the Robert F. Stockton, having an Ericsson propeller, was brought to this country in 1839. Then the propeller began to come into use, both on the Atlantic coast as well as on Lake Erie and Lake Ontario, and it is altogether probable that its largest development in the first decade was on the northern lakes. See also NAVAL CONSTRUCTION; SHIP-BUILDING.

J. H. MORRISON,
Author of 'History of American Steam Navigation.'

Steamboats. See STEAM VESSELS.

Stea'rates. See STEARIC ACID, etc.

Stear'ic Acid, Stearates, and Stearin. Stearic acid is an organic, fatty acid, which occurs (in combination with glycerin) in many of the fixed natural fats, and especially in those which are relatively hard at ordinary temperatures. It has the chemical formula $C_{18}H_{35}O.OH$, and is monobasic, the only one of its hydrogen atoms that is replaceable by a base being that in the hydroxyl radical. Stearic acid is insoluble in water, but dissolves in alcohol and in ether, from which it is deposited in the form of brilliant pearly crystalline scales or plates. It melts at 156° F., but cannot be boiled under normal atmospheric pressure without partial decomposition. Under a pressure of 15 millimetres of mercury (about one fifteenth of an atmosphere), it boils at 450° F., and may be distilled without change. Its density, at ordinary temperatures, is practically the same as that of water. It has neither taste nor odor. It burns very much like wax, and is extensively used in the manufacture of fine candles, either alone or when mixed with paraffin. Stearic acid forms salts (known as "stearates") with alkalies, alkaline earths, and metallic oxids; ordinary soap (q.v.) usually containing a greater or lesser proportion of stearate of sodium or of potassium. With glycerin, stearic acid forms three well-defined compounds, which are respectively known as "monostearin," "distearin," and "tristearin." Of these the last is by far the most important, since it occurs in large quantities in many of the natural fats. Tristearin (which is the substance that is understood when "stearin" is mentioned without further qualification) may be prepared by filtering melted suet to remove the fibrous matter that it contains, and subsequently dissolving the tristearin from the filtrate by the aid of hot ether. Upon the evaporation of the ether, tristearin separates in the form of white, lustrous plates, which are not greasy, though they are soft to the touch. It is insoluble in water, but dissolves readily in ether, and, to a lesser extent, in hot alcohol. The so-called "stearin" of which candles are made is not true stearin, but stearic acid, as noted above. The stearins may be prepared artificially by heating stearic acid with glycerin, provided too high a temperature is not attained; the resulting compound being monostearin, distearin, or tristearin, according to the proportion of the mixture, the temperature to which

Digitized by Google

it is exposed, and the duration of the treatment. Glycerin has the formula $C_3H_5(OH)_3$, and, from the chemist's point of view, it is a tri-atomic alcohol; — that is, it is a tri-hydrate of the fatty organic radical «propenyl» (or «glyceryl»), C_3H_5. Stearic acid, similarly, is regarded as the hydrate of the monovalent radical «stearyl,» $C_{18}H_{35}O$. When stearic acid and glycerin combine, the action consists in the replacement of one, two, or all three of the hydrogen atoms in the hydroxyl radicals of the glycerin by an equal number of stearyl radicals; and the prefixes «mono-,» «di-,» and «tri-,» in the name of the resulting compound, refer to the number of stearyl radicals that are present. The reaction, in the case of tristearin, is as follows:

$$\underset{\text{Glycerin}}{C_3H_5(OH)_3} + \underset{\text{Stearic acid}}{3C_{18}H_{35}O.OH} = \underset{\text{Tristearin}}{C_3H_5(O.C_{18}H_{35}O)_3} + \underset{\text{Water}}{3H_2O}.$$

Tristearin possesses the singular property of having two melting points. Thus pure tristearin melts when it is heated to 131° F.; but if the temperature is raised, it becomes solid again, remaining so until, at 162° F., it takes the liquid form a second time. Commercially, stearin is obtained by straining liquefied fat, cooling the filtrate (sometimes nearly to 32° F.), and expressing the fluid portion by the application of great pressure. The solid part that remains behind consists very largely of stearin, though a really pure product cannot be obtained by this method. Upon treatment with superheated steam, especially in the presence of a small quantity of lime, tristearin is resolved into stearic acid and free glycerin; and this process, or some modification of it, is largely used in the arts for the preparation of commercial stearic acid. Pure stearic acid may be prepared by the following method: Suet that has been melted and strained is saponified by prolonged heating with an aqueous solution of sodium hydrate; the glycerin that the fat contains is thereby liberated in the free state, while the fatty acids combine with the sodium, to form the stearates, palmitates, and oleates of sodium. Sulphuric acid is then added to the solution, with the result that sulphate of sodium is formed, and the fatty acids that were combined with the sodium are set free. The stearic acid that is thus precipitated (and which is quite impure) is removed from the solution, and recrystallized from solution in hot alcohol. An alcoholic solution of these crystals is then mixed with a boiling alcoholic solution of magnesium acetate, by which means an insoluble precipitate of magnesium stearate is obtained. The magnesium stearate is finally decomposed by the addition of hydrochloric acid, and the liberated stearic acid is then crystallized once more from alcohol. The substance known as «shea-butter» is a specially favorable material for the preparation of stearic acid, since it contains no other solid fatty acid. Shea-butter resembles palm oil, except that it is notably redder, and it is prepared from the fruit kernels of the karite, or shea-tree (*Butyrospermum Parkii*), which grows in central and western Africa. Shea-butter is used by the natives of Africa as an article of food, and it is now imported into Europe in considerable quantities, for the manufacture of soap.

A. D. Risteen, Ph.D.,
Editorial Staff, 'Encyclopedia Americana.'

Stearin. See Stearic Acid, etc.

Ste'atite, the mineralogical name for soapstone. See Talc.

Stedman, Edmund Clarence, American poet and critic: b. Hartford, Conn., 8 Oct. 1833; d. New York City 18 Jan. 1908. He studied at Yale, in 1856 began contributing to various New York journals, was Washington correspondent of the *World* in 1861-3, then held a post in the office of Attorney-General Bates, but in 1869 entered on a business career in New York, where until 1900 he was a member of the stock-exchange. After the appearance of his first collection, 'Poems, Lyric and Idyllic,' in 1860, he published several books of verse, such as 'The Blameless Prince, and Other Poems' (1869), 'Hawthorne, and Other Poems' (1877), 'Lyrics and Idyls, with Other Poems' (1879), and 'Poems Now First Collected' (1894). 'Pan in Wall Street' is one of his best poems. His 'Victorian Poets' (1875) has passed through many editions; it is a judicial, careful, and sufficiently learned work, and much better than his 'Poets of America' (1885). He also edited a 'Victorian Anthology' (1895) and 'An American Anthology' (1900), the latter of which was criticised for too great catholicity, while both displayed wide knowledge. The 'Library of American Literature' (1888-9) was prepared by him with E. M. Hutchinson. His Turnbull lectures at the Johns Hopkins University appeared as 'The Nature and Elements of Poetry' (1892).

Stedman, Fort. See Fort Stedman.

Steedman, stēd'man, **Charles,** American naval officer: b. Charleston, S. C., 24 Sept. 1811; d. 1890. He entered the navy as midshipman in 1828, was promoted lieutenant in 1841, and in the Mexican War was in command of the siege guns in the naval battery on shore during the bombardment of Vera Cruz. In 1855 he was appointed commander and sailed in the brig Dolphin in the Paraguay expedition. During the Civil War he remained loyal to the Union. In 1861 he commanded the railroad ferry steamer Maryland that conveyed Gen. Butler and the 8th Massachusetts Regiment from Havre de Grace to Annapolis; and later, after assisting Admiral Foote in organizing the naval forces along the Mississippi River, commanded the steamer Bienville at the capture of Port Royal, S. C. In the following year he commanded the Paul Jones during the engagement and capture of Fort McAllister, and later operated on the St. John's River, Fla. In September 1862 he was promoted captain, and in the Powhatan was engaged in the blockade of Charleston. With the steamer Ticonderoga he pursued the Confederate cruiser Florida to the coast of Brazil, and took part in the two attacks on Fort Fisher in 1864. In 1866 he was promoted commodore, and had charge of the Boston Navy Yard in 1869-72. He was appointed rear-admiral in 1871 and retired in 1873.

Steedman, James Barrett, American soldier: b. Northumberland County, Pa., 30 July 1818; d. Toledo, Ohio, 18 Oct. 1883. He removed to Ohio in 1837 and entered the legislature of that State in 1843. In 1851 he was appointed by President Buchanan public printer at Washington, and at the opening of the Civil War became colonel of the 4th Ohio Regiment and fought in western Virginia and Kentucky in 1861-2. In July 1863, having already been

Digitized by Google

promoted brigadier-general, he was placed in command of the 1st division of the reserve corps of the Army of the Cumberland, and for his services at Chickamauga was promoted major-general 24 April 1864. He took part in the Atlanta campaign; defeated Gen. Joseph Wheeler's cavalry in June 1864, and served with Gen. Thomas at Nashville while Sherman was making his march to the sea. He was made provisional governor of Georgia, but resigned and received the appointment of collector of internal revenue at New Orleans. He subsequently became chief-of-police of Toledo and editor of the 'Weekly Ohio Democrat.' In 1887 a monument was erected to his memory in Toledo.

Steel. Steel may be defined as a modified form of iron, an alloy of iron and carbon, not found in nature, and of the greatest industrial importance. More exactly steel has been defined by Howe as iron which is malleable at least in one range of temperature; and is either cast into a mass that is initially malleable; or is capable of hardening by sudden cooling, or is both so cast and so capable of hardening. Steel is sometimes defined as a modified form of iron containing more carbon than wrought iron and less than cast iron, but this definition is not exact, since some so-called mild steels contain as little carbon as wrought iron. The physical properties of commercial forms of steel vary widely according to variations in the amount of carbon present, the mode of its association with the iron, etc. Steel is an alloy, that is, a metallic mixture usually containing three classes of ultimate constituents: (1) pure metals, (2) definite chemical compounds of these metals with each other and definite chemical compounds of the metals with metalloids like sulphur and carbon, (3) solid solutions, called also isomorphous mixtures of the metals, in which the metals are intimately mingled but not in definite ratios. The study of metals under the microscope (called metallography) during the past 20 years has greatly increased our knowledge of the composition and structure of alloys. For instance alloys have many resemblances to igneous rocks, that is, rocks formed by cooling from a state of fusion. These rocks exhibit all gradations from a structureless glass, in which the elements are indiscrimately mingled, through rocks in which certain definite minerals have crystallized out, to those that are completely crystalline, the elements all being combined as definite chemical compounds in the form of determinable minerals. Following this analogy we have alloys that are partly crystalline, the crystals of metals and of certain definite chemical combinations of the metals and metalloids lying in a solid solution. Such alloys may be said to have a porphyritic structure, while those that are completely crystalline may be called granitic. The structure of an alloy is studied by using means to differentiate the surface of a mass, such as continued gentle rubbing which causes the harder constituents to stand in relief, the use of a solvent which attacks one constituent more than another, the use of a stain which will adhere to or slightly penetrate certain constituents or a combination of two methods. The surface after treatment is observed through the microscope.

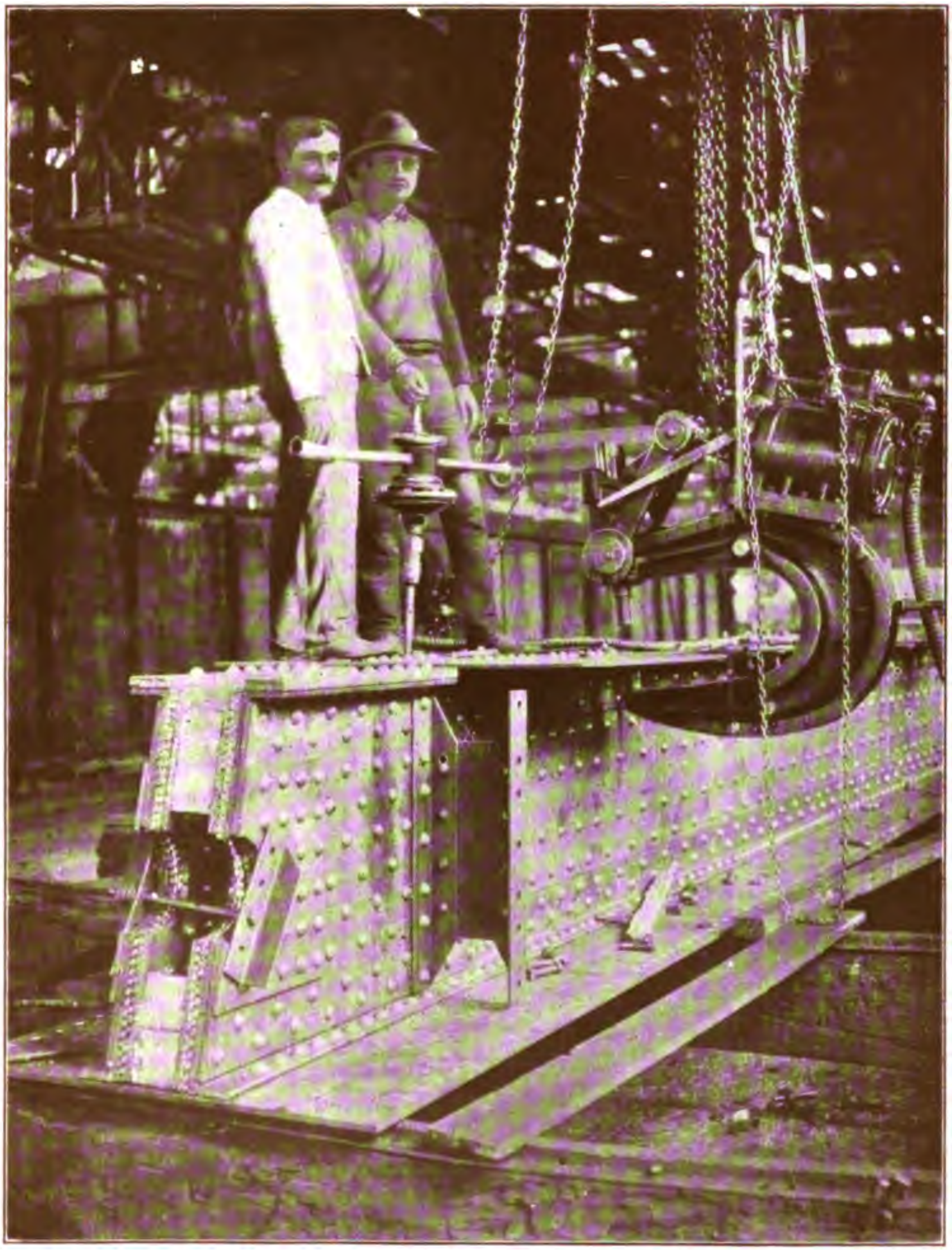
Microscopic Structure.— Under the microscope ordinary commercial iron and steel are seen to be mixtures of minute particles of definite substances in widely varying proportions. The principal substances are: (1) ferrite, pure metallic iron, extremely soft and ductile, and (2) cementite, an iron carbide (Fe_3C), extremely hard and brittle. To the different ratios of ferrite to cementite are due the different properties of the many varieties of iron and steel, what is known as "hardened" steel excepted. The soft steels consist almost wholly of ferrite, with perhaps 1 per cent or less of cementite; in harder steel there is about 92.5 per cent of ferrite and about 7.5 per cent of cementite; this per cent of cementite representing 0.5 per cent of carbon in the steel. The other important constituents of iron and steel are graphite, slag, and austenite. Graphite, an important constituent of gray cast iron, and slag, a silicate of iron and an important constituent of wrought iron, are not found in true steel, but all steel hardened by sudden cooling from a red heat contains austenite, a solid solution of carbon in iron, forming a hard, brittle mass. The percentage of carbon varies from 0 to 2 per cent (from 0.75 to 2 per cent in commercial grades of hardened steel). Pearlite, a solid solution alloy consisting of interwoven microscopic plates of ferrite and cementite, contains about 0.9 per cent of carbon, and is the essential ingredient of slowly cooled steel, the rest of the mass

CARBON CONTENT, PROMINENT USES, AND MICROSCOPIC CONSTITUTION OF STEEL.

Total carbon per cent	Unhardened steel, or pearlite series					Hardened steel or austenite series		
	Name	Uses	Microscopic constitution Per cent			Name	Uses	Microscopic constitution
			Ferrite	Cementite	Graphite			
0.05 to 0.3	Low carbon or mild steel	Wire, sheets, boiler and ship plates, structural shapes	99.25 to 95.5	0.75 to 4.5		Low-carbon steel, hardened	Little used	Chiefly low-carbon austenite
0.3 to 0.8	Medium carbon steel	Axles, shafting, tires, rails	99.5 to 88.0	4.5 to 12.0		Medium-carbon steel, hardened and tempered	Some springs	Chiefly medium-carbon austenite
0.8 to 2.0	High-carbon steel, unhardened	Little used	88.0 to 70.0	12.0 to 30.0	Usually little or none	High-carbon steel, hardened and tempered	Springs, cutting tools	Chiefly high-carbon austenite

Digitized by Google

STEEL BRIDGE BUILDING.



RIVETING A MASSIVE 35-TON CHORD SECTION ON BRIDGE AT THEBES, ILL.

Digitized by Google

Digitized by Google

being chiefly ferrite in steel containing under 0.9 per cent carbon and cementite in steel containing over 0.9 per cent.

Classification of Steel.— The important varieties of steel and iron may be, according to Howe, classified in four different ways: (1) by presence or absence of slag, (2) by carbon content, (3) as carbon or alloy steels, (4) by method of manufacture. By the second, which is much the most important way, there are three classes of iron and steel: (1) soft or low-carbon steel and wrought iron (wrought iron contains slag; soft steel does not) with less than 0.3 per cent of carbon; both are soft, ductile, and of little hardening power, but are much stronger than cast iron; (2) medium and high carbon, or half-hard and hard steels, containing 0.3 to 2 per cent of carbon; harder, less ductile and stronger than low carbon steels and with marked hardening power; (3) cast iron, containing more than 2 per cent carbon, weaker and less ductile than the two former classes, with part of the carbon present as graphite.

The carbon content, microscopic constitution and prominent uses of steel may be roughly summarized as shown in the foregoing table.

Alloy Steels.— These steels have come into extensive use for special purposes, and their production will undoubtedly greatly increase. The chief are nickel steel, manganese steel, chrome steel, molybdenum steel and tungsten steel. The qualities sought in these steels are strength and hardness with ductility. Nickel steel contains from 3 to 3.5 per cent nickel and about 0,25 per cent carbon. It has very great tensile strength, hardness and ductility with a high limit of elasticity. For these reasons, practically all battleship armor now is made of it. It is also extensively used for shafting, particularly for propeller shafts, and is being tested for rails. Manganese steel contains about 12 per cent manganese and 1.5 per cent carbon. It has very great ductility with great hardness, in this combination of qualities excelling any other alloy known when it was discovered by Hadfield. It is too hard to be shaped by cutting tools. Heating and cooling does not destroy its temper. It is used for safes. It is also used for rock-crushers and mine-car wheels. Chrome steel, which contains usually about 2 per cent chromium and 0.8 to 2 per cent carbon, has, when hardened by sudden cooling, great hardness with a high elastic limit; hence it is not deformed by shock. It is used for stamp-mill shoes and dies, for armor-piercing projectiles, and for safes. Tungsten steel, which contains usually 5 to 10 per cent of tungsten (sometimes over 20 per cent) and 0.4 to 2 per cent of carbon, retains a magnetic charge well, hence is used for permanent magnets. As it keeps its temper even at a red heat it is used for metal-cutting tools, which will cut even when the heat from friction of the tool is so great that the chips of metal removed glow visibly. One of the first of these so-called self-hardening steels, Taylor-White steel, contained 8.5 per cent tungsten, 3 to 4 per cent chromium and 0.75 to 1.25 per cent carbon. In the latest of these steels the tungsten is sometimes higher and the chromium may be replaced by 1 to 4 per cent of manganese. Molybdenum steel resembles tungsten steel, molybdenum being used because 1 per cent of it replaces in effect 2 per cent of tungsten.

Heat Treatment of Steel.— Steel being an alloy of iron and carbon, the widely different physical properties of different steels are explained by the state in which the iron and carbon are. It is not possible in the limits of this article to discuss these various states, especially as there is wide divergence of opinion regarding certain phenomena observed in heating and cooling steel and the probable accompanying molecular or atomic reactions. It is enough to say that while the principles of the heat treatment of steel rests on results determined by experiment, the explanation of processes is still largely a matter of opinion. The principles involved in heat treatment are the control of the reactions which determine the proximate constitution of the alloy, and the control of the structure. The important reaction in the treatment of steel is austenite + ferrite = cementite. Most methods of heat treatment control both the proximate constitution and the structure. If a piece of steel is cooled suddenly from above a certain critical range of temperature it is made harder and even brittle, and is said to be «hardened»; low carbon steel is very slightly affected; steel containing 1.09 per cent carbon becomes as hard and nearly as brittle as glass, the hardness and brittleness increasing with the rapidity of cooling. «Tempering» or mitigating the hardness is done by a slight reheating; «annealing,» or removing the hardness completely, by reheating to higher temperature. After tempering or annealing, it makes no difference whether the steel is cooled suddenly or not. Suddenly chilled steel is hard and brittle because the austenite has not time to resolve into ferrite and cementite. In annealed steel the austenite is resolved, and though cementite is harder than austenite, the suddenly cooled steel is harder than the annealed because of the great proportion of soft ferrite in the latter. In merely tempering, a little of the ausenite resolves into ferrite and cementite, enough to make the steel less brittle. Hence instruments which require great hardness and are not exposed to shocks, as razors, etc., are tempered at a low temperature, while cold chisels and rock drills, which must not be brittle, have to be reheated to a temperature that will release more austenite. As regards the control of the structure of steel, it may be said that each variety of steel has a certain appearance on breaking, or fracture, and the finer the fracture, as a rule, the better the condition of the metal. The structure, however, varies greatly with the heat treatment undergone. Thus high-carbon steel is made coarse by overheating and the quality of the metal is much impaired. This coarseness of grain may be removed by proper reheating, or, if the metal was so overheated that it is said to be «burned,» by mechanical treatment, that is rolling, pressing, or hammering.

Methods of Manufacture.— See STEEL, MANUFACTURE OF.

Production.— The United States, Germany and Great Britain together produced in 1902 fully 82 per cent of the total production of the world. The United States, with its great supplies of low phosphorous ores in the Lake Superior district, easily leads in the production of Bessemer steel by the acid process, while Germany, relying on the high phosphorous ores of Lorraine and Luxemburg, leads in the pro-

Digitized by Google

duction of basic Bessemer steel. The figures for 1902 are, in tons of 2,240 pounds:

	Bessemer acid	Bessemer basic	Open hearth acid	Open hearth basic	Crucible, etc.
United States........	9,306,471	....	1,191,196	4,496,533	125,000
Germany............	375,778	4,868,885	133,933	2,277,598	....
Great Britain........	1,157,180	668,599	2,676,508	406,780	113,000

The German returns do not give the production of crucible steel. The countries that made over 1,000,000 metric tons of steel in 1902 are in order: United States, 15,186,406; Germany, 7,780,682; Great Britain, 5,102,420; Russia, 1,730,250; France, 1,635,300; Austria-Hungary, 1,143,900. See IRON AND STEEL INDUSTRY; STEEL, MANUFACTURE OF.

Bibliography.— Howe, 'Metallurgy of Steel' (1893) and 'Iron, Steel, and Other Alloys' (1903); Campbell, 'Metallurgy of Iron and Steel' (1903); Hiorns, 'Steel and Iron for Advanced Students' (1903); Roberts-Austen, 'Introduction to Metallurgy' (1903); Harbord, 'The Metallurgy of Steel' (1904); also consult: 'Journal' of the Iron and Steel Institute; 'Transactions' of the American Institute of Mining Engineers; 'The Metallographist'; 'The Mineral Industry'; 'The Iron Age.'

SAMUEL SANFORD,
Formerly Assoc. Editor 'The Engineering and Mining Journal.'

Steel — The Bessemer Process. The Bessemer process is designed to manufacture from the crude product of the blast furnace a comparatively low grade of steel, which is at the same time more suited for certain purposes than that manufactured by any other process. It does not seek to make high-grade tool steel or steel castings (q.v.), but a cheaper grade, for which there is an immense demand, for instance steel rails (q.v.), and structural shapes (q.v.). It occupies a field in which it is and probably always will be supreme, so long as the supply of suitable raw material lasts. Many modifications of the Bessemer process have been introduced, most of which have not met with any success, but one or two have become commercially recognized, such as the Clapp-Griffiths, the Robert, and the Tropenas processes. These latter by variations in the method of applying the blast, or by modifications in the modus operandi, have made changes in the resulting product so that it may be successfully applied to the manufacture of castings, etc., but they are all essentially Bessemer converters. Further notes on these processes will appear later in this article.

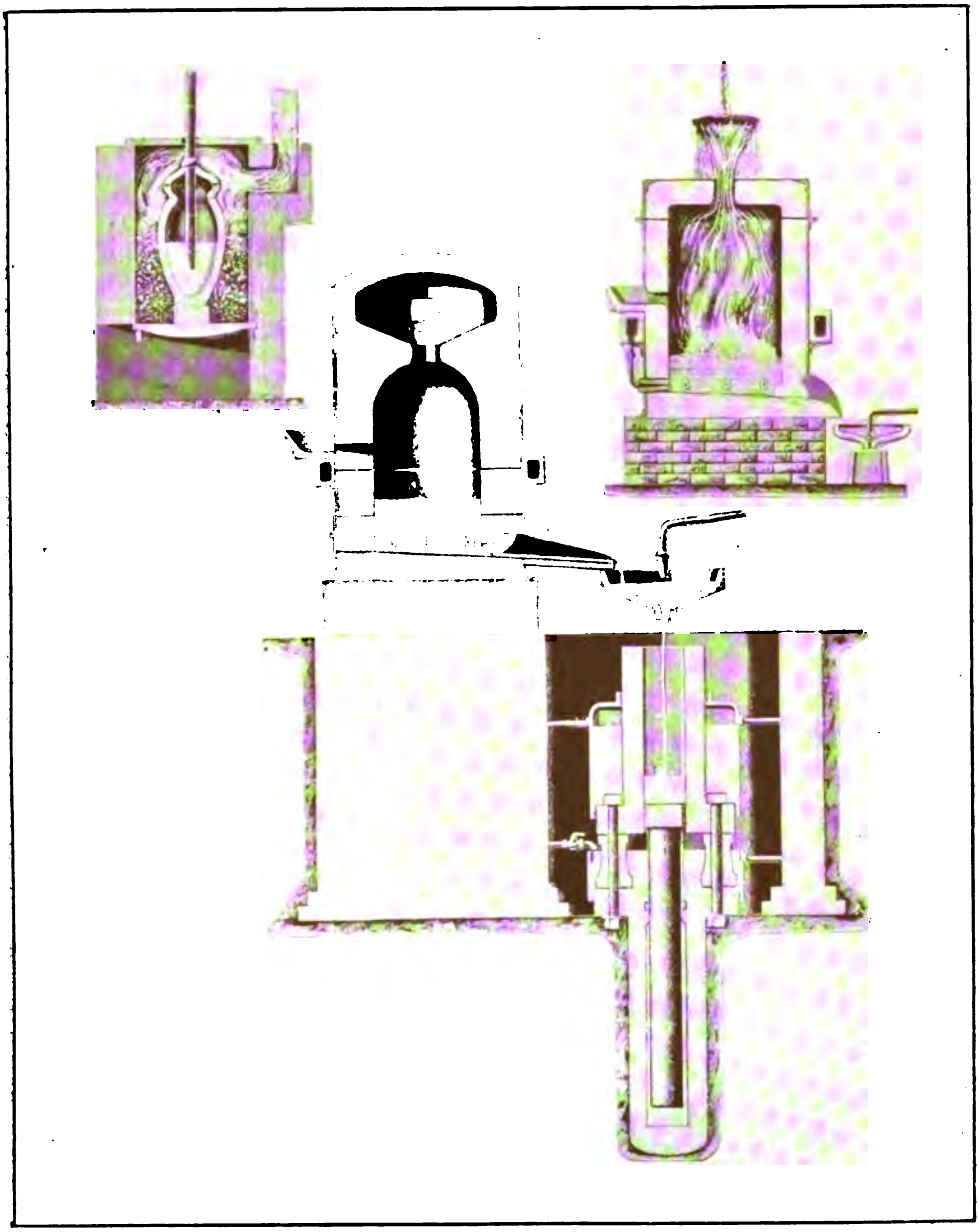
To get a fair idea of the revolutionary nature of this invention mention must be made of the fact that before this time steel, on account of the difficulty of its manufacture, was in use for practically little else but cutlery, springs, and the small parts of machines. It had to be made in crucibles by melting cemented bar or «blister steel,» itself the result of a long and costly operation on Swedish iron in a cementation furnace. A steel rail, building, or bridge was unthought of. Everything was wrought iron, made at great expenditure of time and human energy in the puddling furnace or charcoal bloomary.

The story of how Bessemer came to make his discovery reads like a novel of intense interest. Experiments had been made from time to time to improve iron castings by the addition of wrought iron scrap to pig iron in a cupola, and Bessemer had achieved more success than his contemporaries by the use of a reverberatory furnace instead of a cupola, into which he had introduced great improvements, such as a hollow bridge wall through which jets of air were forced, giving a greater temperature, enabling him to fuse more steel in the bath of cast iron. How he came to discover that great principle on which all pneumatic processes of steelmaking are based is best told in his own words. In connection with the description of some experiments with his forced draft reverberatory furnace he says: «Some pieces of pig iron on one side of the furnace attracted my attention by remaining unmelted in the great heat of the furnace, and I turned on a little more air through the fire bridge with the intention of increasing the combustion. On again opening the furnace door, after an interval of half an hour, these two pieces of pig iron still remained unfused. I then took an iron bar with the intention of pushing them into the bath, when I discovered that they were merely thin shells of decarburized iron, showing that atmospheric air alone was capable of wholly decarburizing gray pig iron and converting it into malleable iron without puddling or any other manipulation. Thus another direction was given to my thoughts, and after due deliberation I became convinced that if air could be brought into contact with a sufficiently extensive surface of molten crude iron it would be rapidly converted into malleable iron.»

With great enthusiasm Bessemer proceeded to the next step, namely, the experimental test of his conviction. He procured a crucible having a perforated cover and a pipe of refractory material passing through the lid, connected to a blast supply. A small quantity of cast iron was melted in the crucible and while still in the furnace a current of air was passed through it. After 30 minutes blowing the contents of the crucible were found to be soft malleable iron. The next thing to be determined was whether the reactions caused by the blowing would generate sufficient heat to keep the contents of the crucible liquid without any heat being applied from outside. This seemed a preposterous idea — that blowing air into molten iron should not only not solidify it in a short time, but actually increase its temperature very materially. But Bessemer was confident it would be so and immediately set about the construction of a converter. The first converter was about four feet in height, cylindrical, having a flat top with a circular opening, and six horizontal tuyeres around the bottom fed by a circular blast pipe. Its capacity was about 700 weight of iron, which was introduced

Digitized by Google

STEEL—THE BESSEMER PROCESS.



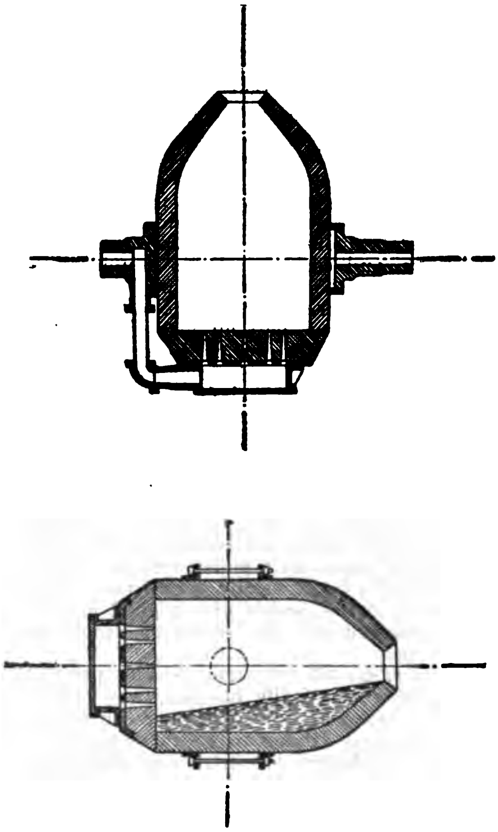
1. The First Experiment in the Crucible.
2. Vertical Fixed Converter.
3. Converter with dome-shaped Top Ladle with Stopper, and Hydraulic Ingot Mold.

Digitized by Google

Digitized by Google

by a sort of funnel in the side after the blast was turned on. The first blow was full of surprises, for what took place could be readily seen, whereas in the former experiments in the crucible the entire apparatus was out of sight. For the first few minutes sparks and smoke were emitted from the converter, but then a flame burst forth, which increased in violence so that no one could go near the converter. Then the flame died down and the metal was tapped out through a hole in the bottom of the converter, and found to be malleable. The possibilities of the process were now demonstrated beyond the slightest doubt, but prodigious labors were yet to be undertaken in order to make it mechanically perfect. The chief difficulties were that during the operation large quantities of slag and some drops of iron were blown out of the converter, and that the blast had to be kept on during the whole time of introducing the charge and also tapping it out when converted. Many changes were made in the interior shape to obviate the first. The height was increased and a double dome-shaped top added with the idea that any projections of slag and iron would strike the dome and drop back into the converter. This was fairly successful and was the type of converter used in the first public exhibition of the process. In order to overcome the necessity of keeping up the blast while filling and emptying the converter the shape which is so well known to-day was evolved after a great many changes and experiments. It had to be a movable vessel, in order to bring the metal away from the tuyeres and permit of shutting off the blast, and so a shape somewhat oval, and with a mouth inclined to one side at an angle, the whole mounted on trunnions, became the standard Bessemer converter. Other vast improvements came quickly, the hydraulically driven rack and pinion to rotate the converter, the hydraulic crane for handling the ladle, and the casting pit for handling of ingots and moulds. One of the difficulties overcome was the mixing of the slag with the iron, and this was overcome by providing a ladle having an opening at the bottom which was closed by a refractory stopper attached to a rod. The iron was run into the ladle and the stopper held in position till it was full. Then as the slag floated the stopper was withdrawn allowing perfectly clean metal to run into the ingot moulds.

The Bessemer process has another peculiar and romantic feature in its history in that it has been twice invented. When he took out United States patents in 1856 Bessemer was confronted at once by a priority of claim to invention by William Kelly. The contention was sustained in the United States courts and Kelly was granted a patent. It is now not doubted that while the two men independently and separately discovered the principle, Kelly was ahead of Bessemer some eight or nine years in his discovery. Kelly was in the iron business in Eddyville, Ky., in 1846, refining iron in an old-fashioned refinery, to make kettles used in the manufacture of sugar. He was an inventive genius, but a poor business man. An inspiration came to him one day while watching the progress of his refinery, on noticing that at a certain place where the blast of air happened to play on the molten iron direct without the intervention of any fuel, it became white hot and boiled violently. He immediately realized the revolutionary nature of his discovery and his knowledge of metallurgy easily furnished him with the explanation, namely that the impurities in the iron were acting as fuel, and by their combustion increasing the temperature of the iron. On speaking of his hopes he was met with derision, but proceeded to make a public



Modern Rotary Converter.

demonstration which convinced all who saw it. But, like all important discoveries, there was a hard battle ahead of Kelly. There is always a prejudice against such revolutionary discoveries, and Kelly's customers refused to accept iron refined by the new method even though it passed the customary tests. His financial backing was also withdrawn, but Kelly could not be extinguished. How he persevered with his process when experiment after experiment failed, how he worked secretly in the forest, and finally got permission from the Cambria Iron Works to erect a converter (the eighth he had constructed) in their works, and how after a disastrous commencement success was finally achieved, are familiar stories. Kelly was recognized as the inventor of the Bessemer process, and while Bessemer's patents were refused renewal, Kelly's were renewed. He died in 1888.

The Bessemer Process To-Day.— In modern American practice the pig iron is sometimes used direct in a fluid condition from the blast

Digitized by Google

furnace and sometimes remelted in cupolas. Rapid working is the object aimed at so as to avoid loss of heat by radiation, and permit of the use of lower silicon in the pig iron. To-day about one per cent of silicon is contained in the charge, and the blow is made in from 9 to 12 minutes. Even with this comparatively low content of silicon the blows are sometimes too hot and steel scrap has to be added in the converter during the blow to cool it off. In place of scrap a jet of steam is sometimes turned on. As regards the capacity of the converter, anything less than 10 tons is considered a small converter and the usual amount treated at one time is from 10 to 20 tons. It is almost universal practice to use an "acid," that is a silicious lining consisting of brick, sand, or stone, and the walls are lined to a thickness of about one foot. The bottom section of the converter containing the tuyeres is separate from the main section and is about 26 inches thick on account of the great amount of corrosion that takes place there, and each vessel has a number of extra bottoms so that they can be quickly changed when burned out. The diameter of the tuyeres is about half an inch. The pressure of blast applied varies from 30 to 10 pounds, the former being used at the commencement of the blow and the latter being the lowest it would ever be safe to reduce it to, and this only when the blow is particularly hot or the projections of slag excessive. Sufficient air must always be kept on to support the iron and prevent it running into the tuyeres and wind box. The converters are rotated to suit the exigencies of blowing, and receiving or pouring the metal, by means of a pinion attached to the trunnion, and a hydraulically driven rack. The illustrations to this article give a good idea of the development of the converter from the earliest type.

The Clapp-Griffiths Bessemer.—This process, which is now practically obselete, was one of the earliest types of Baby Bessemer converters. Its capacity was from two to three tons. A stationary side-blown converter was used, having a slag spout at one side from which the slag poured during the boil. The converter was in two sections, being jointed on a line above the tuyeres, and the bottom section was handled and put in place on a car which could be lifted by a hydraulic ram. The only original feature of the converter was the slag spout, and the benefit derived from its use was always problematical. It was claimed that the steel made in this converter, even though high in phosphorus, was vastly superior to that made in ordinary converters. This claim was of course not substantiated.

The Robert Process.— In this process a rotary converter was used with horizontal tuyeres placed tangentially, in order to impart a rotary motion to the metal. The tuyeres were submerged, but near to the surface of the bath. Whilst the loss was greater than in the ordinary vessel, a hotter steel was made, which was suitable for steel castings, and for this purpose it was almost exclusively used.

The Tropenas Process.— This has been by far the most successful development of the Bessemer process, introducing a new idea, the reasonableness of which is attested by the increasing number of plants being erected and the uniform success with which they are meeting. The Tropenas idea is that the violent mechanical disturbance of the bath is unnecessary and that the more tranquil the bath is the purer, sounder, and better will be the steel. A rotary, side blown converter of two tons capacity is used, and the tuyeres are arranged in a symmetrical position from the centre tuyere in order that any tendency to stirring or rotation may be neutralized. The tuyeres, moreover, are never beneath the surface of the metal, though they approach it very nearly. A second row of tuyeres is placed a few inches higher than and parallel with the lower tuyeres, and when the carbon flame appears these tuyeres are opened, admitting air to complete the combustion of carbon from CO to CO_2. The result of this is to increase the temperature of the bath by radiation. A high silicon, high manganese mixture is used in the converter, and results in exceedingly hot steel, which can be carried around in hand ladles and poured into very small and complicated shapes.

When the blast is first started the surface only of the metal is oxidized, three pounds pressure of air being used, and by dilution and change of specific gravity a fresh surface is constantly presented to the action of the blast without any mechanical disturbance whatever. In this way the possibility of occluded gases is reduced to a minimum, no more air being introduced than is necessary for the chemical reaction.

The Roll of Honor.—The history of the development of the Bessemer process in the United States is the history of a company of the brightest minds this country has produced. There is no doubt that the Bessemer process is worked more perfectly in America than elsewhere, and the credit must be given to those brilliant men who in the early days gave their great intellects to its problems and overcame them. The most important work has been done by A. L. Holley, John and George Fritz, William R. Jones, and Robert W. Hunt. To Alexander Lyman Holley, one of, if not the foremost American engineers, were granted 10 patents in connection with the Bessemer process alone, some of them being raised converters, hydraulic cranes, accumulating ladles, and converter bottoms. Holley investigated the Bessemer process in England in 1863 and realizing its possibilities and also its defects, obtained the only American license, and set to work to perfect its machinery. The latest and most important of the modern improvements is the Jones metal mixer, which is a large storage receiver in which the various quantities of iron direct from the blast furnace are stored and equalized, so that the silicon is uniform in the converter. One of the most important links in this perfectly welded chain was the work of Robert Mushet, who developed the method of recarburizing the iron after blowing in the converter. Without his method it would never have been a commercial success. Considerable trouble was caused in the early days by the confliction of the Bessemer and Kelly patents. The Winslow, Griswold & Holley Company at Troy had control of the Bessemer patents covering the important and essential machinery, and the owners of the Kelly and Mushet patents could not operate without the use of this ma-

Digitized by Google

chinery. In fact each side was necessary to the other and naturally this resulted in an agreement by which a joint-stock company of all the pneumatic steel manufacturers was made. All the patents on these processes have now expired. But of the extent to which Bessemer steel has affected modern civilization an idea may be gained from the simple statement that the yearly output of this material in the United States is now about 15,000,000 tons.

ARTHUR SIMONSON,
Metallurgical Engineer, Philadelphia, Pa.

Steel — Electrical Processes of Manufacture. Electrometallurgical processes for the manufacture of pig-iron, steel, and ferro-alloys, have of late attracted profound attention among steelmakers and engineers; indeed this branch of the iron and steel industry is of such recent origin that the most sanguine of inventors a decade ago would not have dared to predict even the degree of success which we see to-day. One must not on this account imagine that the electrical furnace is of such recent date.

Siemens reduced ores in an electrical crucible furnace in 1879. This was merely a laboratory experiment but within a few years' time Cowles Brothers, Hall, Acheson, and Willson, all Americans, developed industrial processes employing electrical heating. The sudden rise and decline of the calcium carbide industry, during the closing years of the 19th century, in those countries possessing ample and cheap water power, stimulated invention and experiment with electrical furnaces of many types.

The carbide furnaces were not suitable for steel manufacture, but by slight modifications became well adapted to the production of ferro-chromium, of high carbon contents. Prior to 1900 this alloy had been made exclusively in cupolas or small blast furnaces. So successful has the electrical method proved that to-day much of the ferro-chrome, also ferro-tungsten, ferro-molybdenum, ferro-vanadium, and ferro-silicon, is produced electrically. The electric-furnace manufacture of ferro-alloys is an established success; not so much can at this time be said for the electrical manufacture of iron and steel. Few processes have passed the strictly experimental stage, but doubtless the next few years will show wonderful development along these lines. There are now being erected in Europe and America probably a score of Kjellin, Héroult, Keller and other plants.

Exact data is lacking as to the performances of many of these so-called processes. The inventors describe them in terms of their expectations rather than of their achievements, and concerning many of them one looks in vain for exact data as to cost and analysis of the product, though assured that the cost is a mere trifle or that sulphur and phosphorus are readily eliminated by some mysterious means not made clear.

Inventors have injured their cause by claiming too much and implying that in some mysterious manner electrical heat will eliminate defects in analysis and character of the product and produce results which may not be attained by other means. «Unfortunately,» says R. A. Hadfield, «there seems to be fixed in the minds of some of those exploiting such processes the idea that all steel now made is radically of bad quality.»

The belief is fast becoming general that the future of the electrical furnace will be limited to special branches of the industry and to special localities. It will never become a serious rival of the blast furnace, the Bessemer, or Siemens-Martin processes in the United States, Germany, or Great Britain; it may mean much to Brazil, Chili, Canada, and other countries rich in ore and abounding in water power but lacking cheap metallurgical fuel.

Metallurgically considered electrical furnaces are of two kinds: first, purely melting furnaces, analogous to the crucible steel process, *e. g.*, the Girod or the Colby and Kjellin induction furnaces; and, second, smelting or refining furnaces, such as the Keller or Héroult furnaces for either pig-iron or steel. In furnaces of the melting type we must start with the best raw materials if we wish to produce the best steel. Furnaces of the second type may be used, (a) for the electrical refining of pig-iron direct from the blast furnace; (b) for melting and refining cold pig-iron and scrap; (c) for the direct reduction of iron from its ores, with or without subsequent refining to produce steel, and (d) the electrical refining furnace, such as the Héroult, may be used as an adjunct to the open-hearth or Bessemer process, in which the preliminary refining is done.

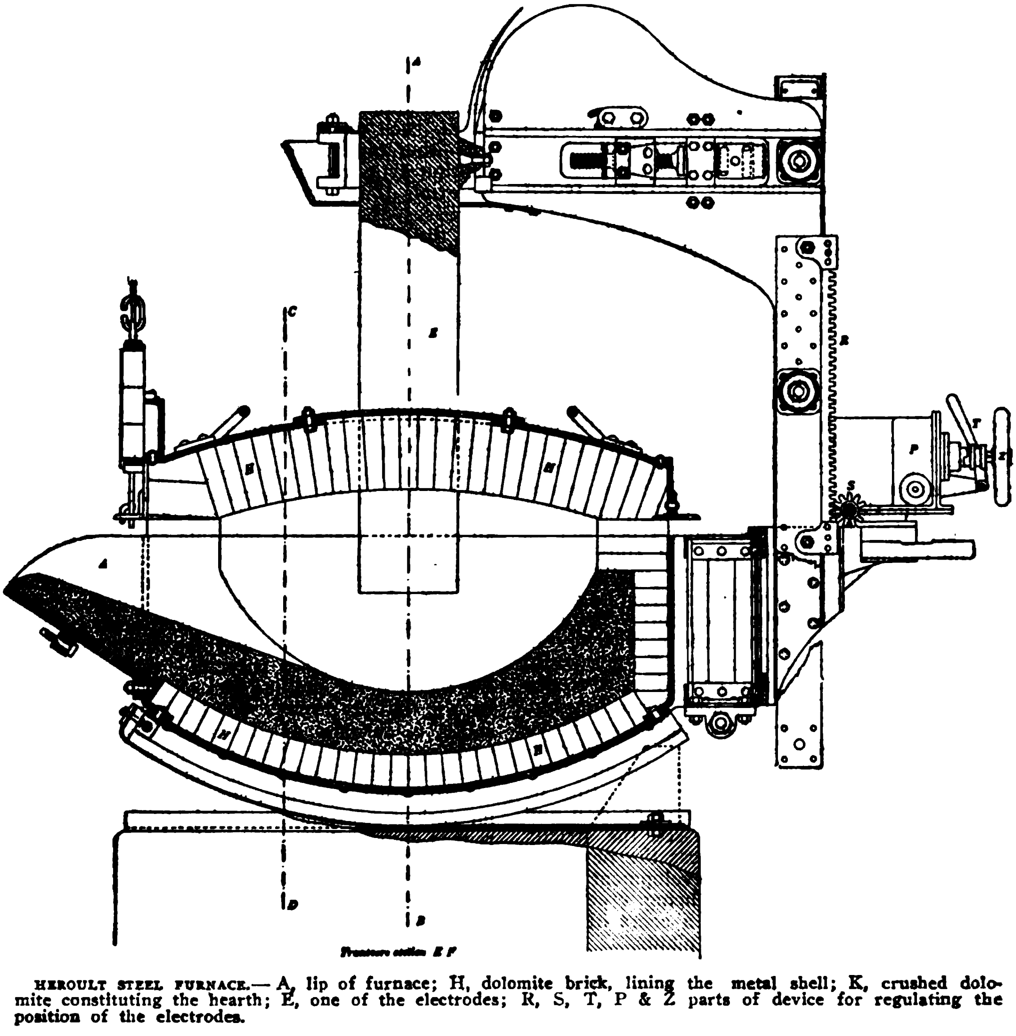
Electrically considered these furnaces include: (a) Arc furnaces, *e. g.*, the Stassano process; (b) arc-resistance, *e. g.*, the Héroult steel process; (c) resistance furnaces, the Keller, Harmet, and Héroult pig-iron furnaces, in all of which there is a movable carbon electrode and the hearth constitutes a fixed electrode. These furnaces are especially suited to the reduction of iron ores, the charge of ore, lime, and coke constituting a resistance conductor between the movable electrode and the fixed electrode. In the Gin process a current is passed through the metal itself, making use of the Joule effect. In the Girod process we have what may be called a furnace of the superficial resistance type; the current does not pass through the charge itself. The furnace consists of a crucible of refractory materials, surrounded by a granular carbon resistance material to which the current is conveyed by solid carbon conductors and the whole device is enclosed in refractory and non-conducting materials for thermal and electrical insulation. (d) Induction furnaces. The invention is due to E. A. Colby, but Kjellin, Schneider, and others employ the same principle. In them the heating current is an induced one, generated in an annular bath of metal constituting a single-turn-secondary of a step-down transformer. In the original Colby patents the primary windings of the transformer surrounded both the electromagnet and the crucible itself. In the Kjellin process the primary winding is close to one leg of the electromagnet and both are surrounded by the single-turn-secondary or crucible itself. It would appear that there might be an advantage in dividing the primary winding into two parts, one within and one without the crucible-secondary, in other words in combining the Colby and the Kjellin construction in the same furnace.

In this limited space only a few typical processes can be described, for the varieties are already legion and new ones are being patented continually.

Digitized by Google

The Stassano Process.—In the Stassano furnace the heat is radiated from one or more pairs of large carbon electrodes placed above and in the top of the furnace. The furnace is of the arc type, and as the electrodes are not in contact with the materials to be smelted, it is claimed that no impurities are introduced into the melt from the electrodes themselves. Either iron or steel may be produced depending upon the mixture used. The hearth of the furnace rotating during the operation at a small angle to the vertical facilitates the mixing of the ingredients and the reactions taking place in them. Captain Stassano has published results of five heats in which very pure iron was produced direct from ore, nearly 40 per cent of the sulphur of the charge and over 85 per cent of the phosphorus having been eliminated. The consumption of electrical energy varied from 4.2 to 7.0 horse-power hours per kilogram of steel produced. The lower figure resulted when a less intense current than that at first deemed necessary was used. Stassano estimates that, with an installation of 30 tons per day capacity, having provision for utilizing the carbon-monoxide produced in the furnace, steel can be produced, with the cheap electric power of Italy, at a cost quite comparable with that of Bessemer steel in Germany, England, or the United States.

The Héroult Process.—This process as applied to the production of steel makes use of an arc-resistance tilting furnace, usually basic lined with dolomite or magnesite brick. Two large electrodes pass through the roof of the furnace and the current passes down one of these across a narrow air-gap, through the slag into the metal and is thence conducted back through the slag and another air-gap to the second electrode. At La Praz, the home of the inventor, Dr. P. L. T. Héroult, an alternating current of 110 volts and 4,000 amperes is employed. The width of the air-gaps is automatically regulated. According to the figures of the Canadian Commission tool steel can be made in this furnace from cold scrap with the absorption of about 0.153 electrical horse-power years per ton of product. Steel of structural



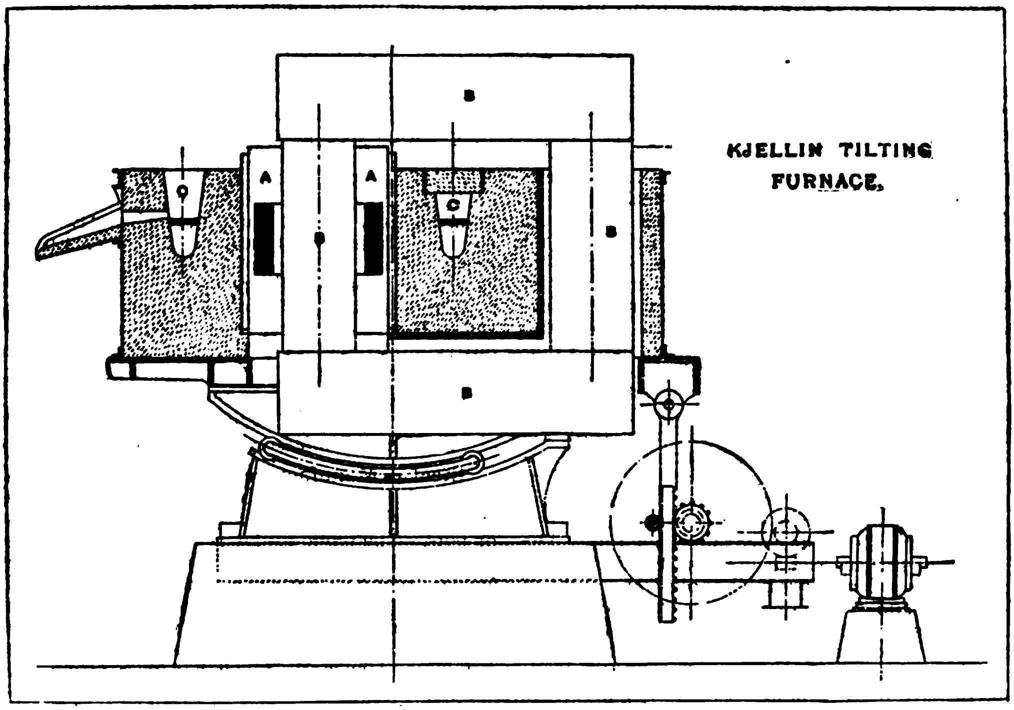
HEROULT STEEL FURNACE.— A, lip of furnace; H, dolomite brick, lining the metal shell; K, crushed dolomite constituting the hearth; E, one of the electrodes; R, S, T, P & Z parts of device for regulating the position of the electrodes.

Digitized by Google

quality is made with a still smaller consumption of energy. In addition to the usual mixture of miscellaneous scrap, ore, and lime, Héroult employs lime, sand, and fluorspar for the preparation of artificial slags toward the end of the process, after the first natural slag has been completely removed. These are supposed to remove sulphur and phosphorus and according to Harbord do remove the latter element fairly well, but according to the writer's more recent investigations trouble is experienced in getting either the sulphur or the phosphorus below 0.02 per cent, which is scarcely better than the best open hearth practice, and will not pass for first quality crucible tool steel.

his estimates upon results of the Canadian experiment, Dr. Héroult figures that a large plant, equipped with labor-saving devices, could produce pig-iron at a price between $10 and $11 per ton. In this calculation the cost of electrical energy and ore is very low, and there are so few places where these conditions and prices could be realized that no fear need be felt for the speedy disappearance of the blast furnace.

The Colby and Kjellin Processes.— The inventor of the induction furnace was Mr. Edward A. Colby, an American. It does not appear, however, that at the time of taking out his patents, in 1890, he had any idea his process



A, is just above the primary coil; B, iron core or magnetic circuit; and C, the bath (secondary circuit). The advantages of this furnace are that it can be tipped over the lip, or from the taphole, and can easily be repaired and relined when necessary.

When the Héroult furnace is employed as an adjunct to the open hearth furnace, as at the Halcomb Steel Company, or the Elektrostahl Gesellschaft, at Remscheid, Germany, the great burden of responsibility for dephosphorizing and desulphurizing rests with the open hearth furnace and just what is accomplished by later tapping open hearth metal into the Héroult furnace, where it remains from one to one and a half hours, is not apparent although it is stated that the installation at the German works is working very satisfactorily, and producing excellent steel.

The Héroult pig-iron furnace appears much more promising, according to recent reports by Dr. Haanel. In experiments made in Canada excellent low-sulphur pig-iron was produced from high-sulphur magnetites which could not have been successfully smelted in the blast-furnace. This furnace, which was of the resistance type, had a 92 per cent power factor. Basing

might be used on a large scale for steel melting. More recently Schneider, in France, and Kjellin, in Sweden, have employed the principle of induction to the construction of electrical furnaces for steel melting, and since the results of these later experimenters have been made public, Colby has designed a furnace for a similar use. His furnace has been tried in Philadelphia, and it is stated ('Iron Age', 1906) that heats can be made in an hour in a furnace of about 150 pounds capacity. The primary current is of 220 volts, while the induced current in the bath of metal is about eight volts. The average power consumption is reported as 640 kilowatt hours per ton of steel.

The Kjellin process has been in actual service in Sweden producing merchantable product for about four years, and it has been made the subject of many careful investigations by the Canadian Commission, by Dr. V. Engelhardt, by Dr. J. A. Mathews, and

Digitized by Google

others. The furnace as described by Dr. Haanel constitutes a step-down transformer. The primary coil of insulated wire is wound about one leg of the magnetic circuit. The secondary is formed by the charge in an annular groove, also surrounding the same leg of the magnetic circuit. In Mr. Kjellin's furnace at Gysinge, Sweden, the primary alternating current is delivered at 90 volts and 3,000 amperes. The secondary current induced in the charge itself is of low potential, and the conversion of electrical energy into heat takes place in the substance of the charge. The furnace may be either acid or basic lined, but the latter is most used, the lining constituting the annular groove or crucible being usually made of magnesite. The furnace may be either tilting or stationary. This process corresponds most nearly to the old crucible process in that there is no attempt at purification of the materials used, but carefully selected raw materials, well melted, will give an excellent steel whose analysis is nearly the mean of the constituent materials of the mixture. This is a more expensive way of producing tool steel but it is the only sure way and processes depending upon refining methods can never be as certain in their results as such methods as the crucible or induction process in which raw materials of known purity are employed. The writer differs with Professor Harbord in his conclusion, expressed in the report of the Canadian Commission, that "steel equal in all respects to the best Sheffield crucible steel can be produced either by the Kjellin, Héroult, or Keller processes." The investigations and report of the Commission itself do not warrant this statement, nor do the writer's personal investigations, made two years later. The Kjellin process alone, or rather the induction process, can accomplish or has accomplished this. The induction furnace can operate successfully upon two kinds of mixtures, (a) pig-iron, puddled bar iron, and scrap, or (b) pig-iron, scrap and briquettes (ore). The former require less time and less electrical energy but is the more expensive mixture. It appears that in the Kjellin furnace the consumption of energy decreases as the size increases. In the 170 K. W. furnace at Gysinge, Engelhardt states that an average of 770 K. W. hours per gross ton of ingots is required, using pig, bar-iron, and tool scrap, all charged cold. In a furnace of 736 K. W. capacity he estimates that this figure would be reduced to about 600 K. W. hours per ton. Ibbotson states that for the year ending May 31st., 1906 the works' records show a consumption of 1128 K. W. H. per gross ton of ingots from a pig, scrap, and briquette mixture, and for a mixture without briquettes, the energy consumed was only 886 K. W. H. per gross ton. According to Engelhardt, a large furnace, producing 30 tons a day could do so at a cost to compete with the Siemens-Martin process when electrical energy can be had at 0.5 cents per kilowatt hour.

Conclusions.— The Keller and Héroult furnaces can produce good pig-iron at small cost in places where the cost of electrical power is low. They can produce good pig-iron from ores that cannot be successfully treated in the blast furnace. Excepting where power is very cheap (water power) and metallurgical fuel (coke) very dear they seem at present to offer little possibility of competing with the blast furnace.

For the production of steel, under the same conditions mentioned above, it would appear that the Héroult, Stassano, Keller, Gin, Harmet, and other processes, of a smelting or refining character, will find a considerable field for the ordinary grades, such as structural and rail-steel and common tool steel. In localities where now the steel industry flourishes in all its branches and in which as a rule electrical energy is expensive, only the highest grades of tool and alloy steels can be made commercially by electrical means and furnaces of the induction type will probably be the ones used.

Bibliography.— 'Report of Commission on Electric Smelting of Iron Ores and the Making of Steel,' (Canada, 1904); Keller, 'Journal Iron and Steel Institute,' (1903, Vol. I, p. 161); H. Louis, *ibid* (1904, Vol. I, p. 40, upon Herrang briquette process); Haanel, 'Journal American Chemical Society,' (1906, Vol. XXVIII, p. 921, upon Héroult pig-iron process); B. Neumann, 'Stahl und Eisen' (1904, June 15, July 1, and Aug. 15); also, 'Electrochemical Industry' (1904, p. 488); V. Engelhardt, 'Stahl und Eisen' (1905, Feb. 1, 15, and March 1, upon Kjellin process); Frick, 'Jernkontorets Annaler,' (Vol. LIX, pp. 333–464); 'The Electro-chemical and Metallurgical Industry,' (Vols. I, II, III, and IV, treat the whole subject fully, including patents, theory, and practice.

JOHN A. MATHEWS,
Assistant Manager, Crucible Steel Company of America, Sanderson Brothers Works.

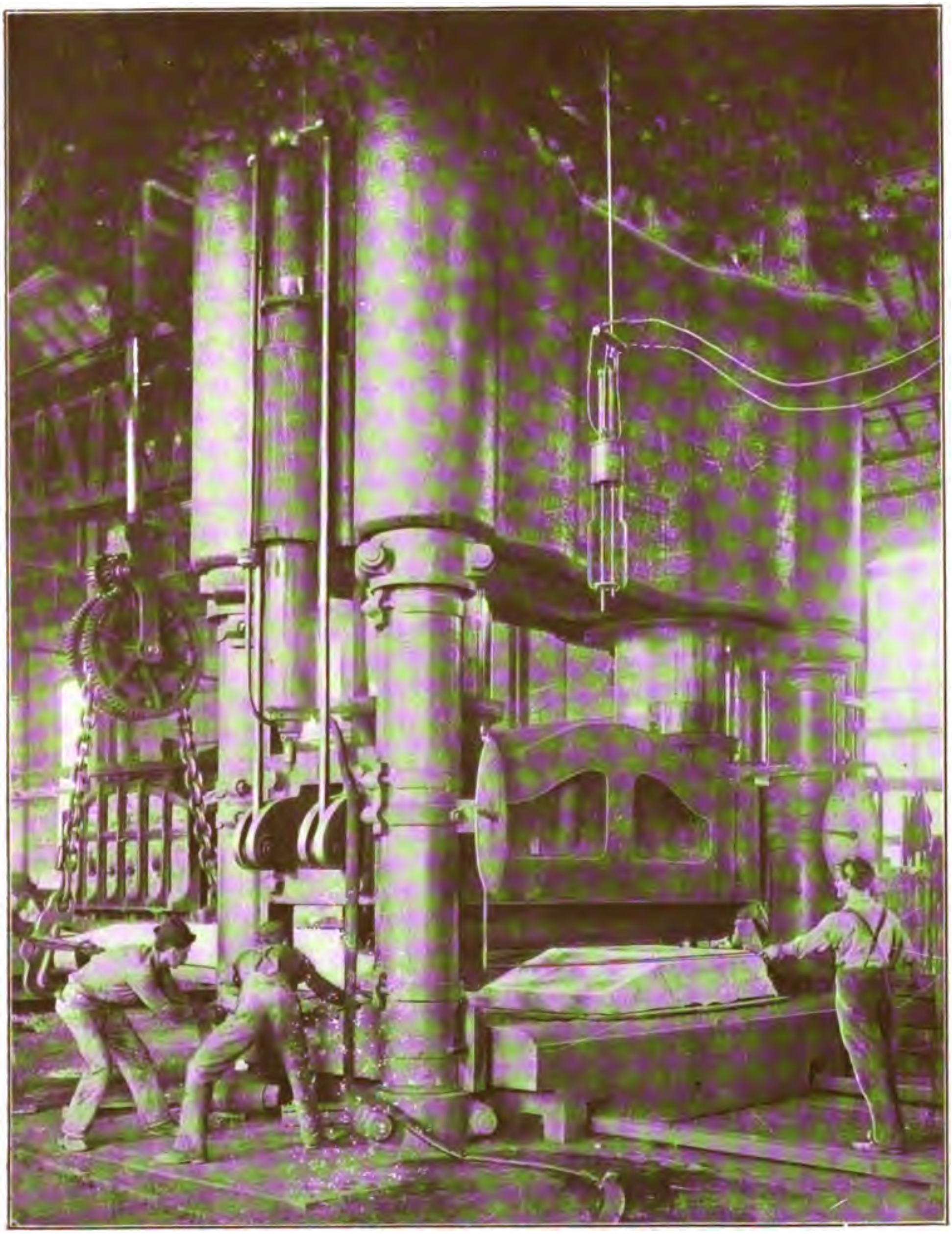
Steel — Manufacture of Crucible. Crucible steel is so called because the ingredients from which it is made are melted in crucibles or pots. The name to-day is almost synonymous with "tool steel"— meaning a steel containing at least one half per cent of carbon, which will therefore harden materially when plunged at a bright red heat into water or oil. Steel of lower carbon than this may be made in crucibles for especial purposes when hardness is not the chief quality desired. For example, steel castings are frequently made of crucible steel. The quantity actually so used in this country is only a few thousand tons per annum.

The practice of hardening steel is of great antiquity and is referred to by the early Roman and Greek writers. The ancient Egyptians heated meteoric iron in the forge until, by long contact with the fuel, it absorbed enough carbon to impart considerable surface hardening when quenched. The difference between oil and water hardening is referred to by Lucretius who says: "The finest tools are tempered in oil, which gives a more durable hardness than that imparted by water."

The fact that iron heated in contact with carbon, absorbs some of that element, which renders it harder, seems to have been known for many centuries and prior to Huntsman's invention, in 1740, all steel for tools was made by the process of cementation. Especially in Austria and England the art and industry of converting pure wrought iron into cement-, or blister-bar flourished, by which, as French says: "A steel was obtained which had uncertain percentages of carbon, higher on the outside than

Digitized by Google

MANUFACTURE OF ARMOR PLATE.



A 14-INCH ARMOR PLATE UNDER A HYDRAULIC PRESS.

Digitized by Google

Digitized by Google

on the inside, and varying in hardness from one end to the other, according as the bar came in contact in the converting furnace, with more or less of the carburizing material, or a higher or lower degree of heat." It was to overcome this lack of uniformity that so-called "single" and "double-shear" were made, but Huntsman conceived the idea of melting the cemented-bar in crucibles, thus rendering it absolutely homogeneous and of uniform carbon contents throughout the mass. As first carried out, the melted steel was allowed to cool in the crucible, which as then broken away and the resulting mass was used as an ingot. About a century ago Mushet patented the production of steel made in the crucible by melting together soft bar iron and a certain amount of carbonaceous matter. This process did not amount to much until 1839, when Heath patented the use of manganese as an essential addition to crucible steel. In America, the Mushet-Heath process of melting together in crucibles soft bar-iron, with or without a certain percentage of steel scrap, charcoal, and oxide of manganese, spiegeleisen, or ferro-manganese is more generally employed than the original Huntsman process of melting cemented or blister-bar. It has been said of Huntsman's invention that,—"The invention of cast-steel was second in importance to no previous event in the world's history, unless it may have been the invention of printing." Huntsman's process was rapidly adopted and at the time of his death there were several firms melting steel, and possibly five hundred individuals and firms making files, edge-tools, etc., in Sheffield,—famous for its "thwytles" since Chaucer's day. Among these names appeared Spencer, Jessop, Sanderson, Parkin, Turner, Hobson and Rogers, and these same names appear today in connection with both English and American crucible steel works.

The Materials.—The base used for all crucible steel is wrought iron. England, Germany and America draw on Sweden for the more expensive grades, and by many it is believed that Swedish materials possess some mysterious virtues not afforded by other irons, regardless of what the results of chemical analysis show. The Swedish irons are all made from charcoal pig-iron and are refined by the Lancashire or Walloon processes. Some have claimed that these irons contain traces of vanadium and that to this they owe their virtue. They usually contain small amounts of manganese, while ordinary puddled irons are nearly free from this element. To the writer this seems more important than a possible trace of vanadium. A careful investigation of products made from Swedish and American irons *of the same analysis* has revealed absolutely no difference in the quality of the product, chemically, physically, or by practical test in tools of divers sorts. Certain it is that rarely does Sheffield tool steel show as great purity as regards sulphur and phosphorus as is seen in the product of American mills. In America, while Swedish iron is still used to some extent, it has been replaced by the purer product of the puddling furnace. This commonly carries less than one-hundredth of one per cent of sulphur and phosphorus, and also contains much less copper than the Swedish irons.

In German and English tool-steels a combined percentage not exceeding 0.06 per cent of sulphur, phosphorus and copper is considered first class, while in America this combined percentage is about one-half as much and would not be expected to exceed 0.04 per cent in the best product.

Swedish bar or puddled bar may be and is melted directly or it may be first carburized by the cementation process. Cemented bar is used more largely abroad than in America. For the purpose of adding carbon, when the cemented bar is not used, it is customary to use either a pure Swedish charcoal pig-iron or the American product known as "washed-metal." Both carry about 4.0% carbon and are low in sulphur and phosphorus, but the former carries rather variable quantities of silicon and manganese, from which washed metal is nearly free. This is an advantage in favor of the Swedish pig, if the silicon and manganese can be maintained fairly uniform and not excessive in amount. In some cases all the carburizing in the crucible charge is effected by means of charcoal. Small quantities of oxide of manganese or ferro-manganese are usually employed, and for special steels metallic nickel, manganese, tungsten, chromium, or molybdenum, or their ferro-alloys are employed.

Crucibles.— In England, clay crucibles are almost exclusively used. They are nearly always made in connection with the works using them, the mixing usually being done by men who tread the clay with their bare feet. Little or no machinery is used in their production. The mixed ingredients are made into balls of suitable weight and these are dropped into a mould and a plug shaped like the inside of a crucible is driven in, forcing the clay up into the mould and around the plug, which is then withdrawn and the crucible removed from the mould and dried for several weeks. Before using, it is "annealed" or baked and is always filled while hot. The crucibles last only about three heats, carrying sixty pounds at the first heat and a less amount on each subsequent charge. This is because the metal attacks and weakens the crucible at the slag line and hence the level of the metal is lowered in the pot on each succeeding heat.

Graphite crucibles are generally used in Germany, Austria and the United States. These according to analyses, quoted by Howe, may contain from 20 to 83 per cent of graphite, about 50 per cent being commonly used in America. The best Ceylon graphite should be used. Artificial graphite made in electrical furnaces is unsuitable for crucibles because of its granular rather than lamellar structure. With the graphite is used either clay or a mixture of clay and old crucibles finely ground. It is also customary to use a little coke dust in making clay crucibles. Graphite crucibles are much larger than clay ones and will carry the customary 90 to 100 pound charge from five to ten heats. They will stand much abuse, especially in the way of sudden changes of temperature, and need not be filled hot each time. Indeed, it is quite customary to allow them to cool off completely between heats, when they are cleaned and inspected. Graphite crucibles cost from five to eight times as much as clay crucibles, but this disadvantage is more than offset by their greater endurance and the much greater production per

Digitized by Google

crucible. The disadvantage frequently mentioned, that they impart variable amounts of carbon and silicon to the steel is more fancied than real.

Furnaces and Fuel.— Several types of furnaces have been employed for crucible steel melting, but such steel for tool purposes is nearly always melted in shaft furnaces using coke as fuel or in Siemens regenerative furnaces using gaseous fuel,— either producer or natural gas. The latter is almost exclusively used in the Pittsburgh district and seems to be the ideal fuel because of its uniformity of composition and its freedom from sulphur. In addition to these fuels, anthracite has been employed to a limited extent in a special form of shaft furnace, somewhat resembling the coke-holes or furnaces. They differ in this, however, that they require forced draft and to provide this the ash-pit is enclosed and air is driven into it and thence through the bed of anthracite on the grate by means of a fan blower. Waste heat from anthracite furnaces may be used for heating steam boilers. Petroleum has been used for fuel in the Nobel furnace, for melting crucible steel for castings, as in the Mitis process. We now hear little of anthracite or petroleum for crucible steel melting, and the writer is not aware that either of these fuels is actually being used in America at the present time.

The Sheffield coke-holes or shaft-melting furnaces, hold only two crucibles each, and they are not run at night. The furnace itself consists of an oval chamber about three feet deep to the grate bars and a foot and a half to two feet in section. These holes are arranged around one or more sides of the melting house. Their cover-bricks are just above the floor level. The melting holes are connected either to separate flues, some half dozen of them being united to form one large chimney, or else the individual flues may be united in a large common flue and stack. The draft is roughly regulated by inserting bricks in the flues. Beneath the furnaces there is always a large ash pit and cellar. In Sheffield the crucibles, after air-drying and annealing, are put into the furnace and well packed around with coke, and the materials to be melted are charged into the red hot crucible through a sheet iron funnel. The crucible rests on a stand and this in turn is supported on the grate bars. The charging being ended, a cover is placed on the crucible, the fire is urged and during the operation the coke must be replenished at least twice. Three heats from a crucible constitute a day's work and require about twelve hours' time, and three heats, also, is about the life of the crucible.

The regenerative gas furnace, which is used exclusively in the United States, has never been popular in England, although it is much more economical as regards fuel consumption. Numerous reasons have been given to explain why it is not used in Sheffield. Strangely enough it has been stated that gas fires are not under such good control as coke fires, or again, that the entire crucible and its contents are not heated to a uniform temperature. Whatever weight these objections may have, it is interesting to note that whenever English capital has been invested in the crucible steel business in America, graphite crucibles and gas-fired regenerative furnaces have been adopted without apparent hesitation.

The American furnace consists of from two to ten melting holes in a row, and each hole will accommodate six crucibles at a time. Each hole is provided with three ports on either side through which the gas and air and the products of their combustion pass. The direction of flow of the gas and air is reversed about every fifteen minutes, in the way common to all Siemens regenerative furnaces. Beneath and at either side of the melting holes are the regenerative chambers, one for gas and one for air on each side. The chambers are filled with so-called checker work of brick, which takes up heat from the outcoming gases or imparts it to the entering gas and air. The furnace of Dawson, Robinson and Pope which is said to be giving very good results at Jessop and Sons, Sheffield, differs from the American furnace in that all four regenerative chambers are on the same side of the melting holes, which have four ports each. The melting hole is curved or horse-shoe shaped on the side opposite the ports. The gas and air thus enter by two of the ports and rush around the curved outer edge of the furnace and down the other two ports. The six crucibles break and impede the passage of the flame and absorb its heat as it passes.

The melting holes have a layer of coke from six to eight inches deep in the bottom and on this rest the crucibles. The crucibles are usually filled carefully by hand, while cold, and are set into the furnace. The crucibles are well adapted to stand this sudden change of temperature if they have been well baked and have been kept in a dry place prior to use. Unlike the coke furnace, the gas furnace is run continuously, day and night, from Monday morning to Saturday afternoon, from 33 to 36 heats constituting a week's work. These furnaces will last from eight months to a year or even longer before the holes need relining or the checker work needs replacing. Coke furnaces require relining about once a month. The first cost of a gas furnace is much greater than that of the coke furnace, but the crucibles are more readily accessible in them and they are much more economical of fuel. A ton of ordinary bituminous coal, burned in a producer, will melt a ton of steel, while the coke shaft furnace requires about three tons of the more expensive coke to melt a ton of steel. Commenting on this phase of the subject, Harbord, the distinguished English authority, says: "The economy in fuel, ease with which gas can be regulated, freedom from clinkers on pots, offer so many advantages over the coke-hole, that notwithstanding past failures of gas furnaces, there seems every prospect of this or some similar gas-fired furnace being very largely adopted in crucible steel melting." By the "past failure of gas furnaces" Prof. Harbord must refer to their failure of general adoption in England rather than in any real difficulty with the gas furnace itself as compared with coke-holes or other furnaces. More crucible steel is melted in gas furnaces than in all other forms combined.

Melting.—The materials being charged into crucible the fire is urged in the case of coke, or more gas is turned on in the case of Siemens furnaces, until at the end of about two or three hours the materials are melted. In the case of

Digitized by Google

mixtures consisting of much high carbon scrap, pig-iron or cemented bar the melting takes place more quickly than with mixtures consisting largely of puddled iron and charcoal. When the melter thinks the contents are about melted, the cover of the crucible is raised and the contents examined by the melter who prods about in the crucible with a long iron rod to detect unmelted pieces. The melting of large pieces of steel scrap takes place in a rather unexpected fashion,— the inside seems to melt first and to run out, leaving a shell looking exactly like the original piece, floating around on top of the metal.

After the materials are «clear melted,» the heating is continued for an extra half hour or more, and this is known as the «killing» heat. If the metal were poured into the ingot moulds immediately after melting, unsound and spongy ingots would result. During the killing some silicon is taken up from the walls of the crucible by the metal and this seems to assist in making sound castings. Then, also, the oxide of iron which is present in the metal has a chance to react with the carbon in the steel or in the walls of the pot and is thus reduced to metallic iron, while oxides of carbon are formed and eliminated. Steel that has been given sufficient killing, if cast in open moulds and allowed to cool spontaneously would be quite free from blow holes, but would be deeply piped. In actual practice means are employed to eliminate the pipe, and the ingots are perfectly sound from top to bottom. The tendency to eliminate gas during solidification is offset in varying degrees by silicon, manganese and aluminum.

The Ingots.—The crucibles, after the killing heat, are withdrawn from the furnaces and the small quantity of flux or slag always present is «mopped» off. The metal is then poured or «teemed» into moulds. The moulds are of cast iron, and usually in two parts, held together by rings and wedges. Before use, the moulds are smoked with resin. When it is desired to make large ingots, the product of any number of crucibles is cast into one mould. Until quite recent years large castings for ordnance, armour and projectiles were made of crucible steel. The Krupp works continued this practice longer than the leading English and American works. Crucible steel ingots weighing 30 tons and above and requiring over one thousand crucibles of metal have been made. It is now 25 years since the general use of crucible steel for heavy ordnance, shafting, cranks, etc., ceased, though some is still used for these requirements.

Grading the Ingots.—The quality of steel depends upon the method of manufacture, the analysis, and the method of handling. Even when of almost identical analysis, crucible steel takes first rank for quality, open-hearth steel stands next and to Bessemer must be assigned last place. The exact reason why this is so is not known definitely, but the fact is generally admitted. The quality of crucible steel depends upon the nature of the raw materials entering into the crucible mixture. In general, the lower the percentages of sulphur and phosphorus the better the steel, and the higher the carbon, the more pernicious is the effect of these unwelcome metalloids. The degree of carburization is generally referred to as the "temper" of an ingot. In a works making hundreds or even thousands of small ingots per day it would manifestly be impossible to analyze each ingot for carbon. Fortunately, this is not necessary. Very small differences in carbon so change the fracture or crystallization of the ingot that the skilled inspector can detect by the eye differences of carbon not greater than one-twentieth of one per cent, within the limits of carbon most used for tool steel, say, 0.90 per cent to 1.40 per cent carbon. The presence of large amounts of tungsten, chromium, molybdenum and other alloying metals interferes with or precludes entirely the estimation of carbon by the eye. Other elements being within the usual limits, *e. g.* silicon and manganese from 0.10 per cent to 0.25 per cent and sulphur and phosphorus from 0.01 to 0.025 per cent the percentage of carbon is the most important factor in determining the suitability of any steel for a given purpose. According to Thallner, steel containing upwards of 1.5 per cent carbon may be called very hard and is suitable for turning and planing knives, drills, razors, etc. Hard steel of 1.25 per cent carbon is suited for ordinary turning and planing knives for use on materials of medium hardness, also for rock drills, scrapers, cutters, etc. Medium hard steel of 1.0 per cent carbon is suitable for screw taps, coining dies, chisels, punches, etc. Thallner calls steel of 0.85 per cent carbon tenaciously hard, and recommends it for screw-taps, cutters, broaches, matrices, swages, pins, bearings, chisels, gouges, etc. Steel of 0.75 per cent carbon is tough and suited to tools requiring rough handling, hammers, shear blades, drifts, springs, cupping tools, and certain kinds of needles. Soft tool steel is rather a misnomer, but the term is used in a relative sense, and applied to steel of about 0.65 per cent carbon, for blacksmith's tools, bolts and for welding to harder steel to stiffen and toughen it. No arbitrary list of this kind can fit all cases. In general, the crucible steel business is one involving a tremendous amount of detail, care and watchfulness. The temperature of the metal must be carefully guarded and controlled at every step,— melting, welding, cogging, rolling or hammering, and when the steel reaches the customer equal care is required to forge, to harden and to temper the finished tool. The proper selection and blending of raw materials or the choice of the proper quality and carbon for a given use, and its successful fabrication may not be learned from books or acquired in a day, but are a legitimate part of the stock in trade of Böhler, in Styria; Jessop or Huntsman, in England; Sanderson or Crescent in America, and other firms with established reputations.

Bibliography.— Howe, 'Metallurgy of Steel' (pp. 296–315); Harbord, 'Metallurgy of Steel'; Thallner, 'Tool Steel'; Woodworth, 'Hardening, Tempering, Annealing and Forging of Steel'; Metcalf, 'Steel, A Manual for Steel Users'; Alling, 'Points for Buyers and Users of Tool Steel'; Percy, 'Iron and Steel'; Kerl, 'Grundriss der Eisenhüttenkunde'; Ostberg, 'Trans-American Inst. Mining Engineers' (XIV, p. 775); Ledebur, 'Handbuch der Eisenhüttenkunde.'

JOHN ALEXANDER MATHEWS,
Assistant Manager, Crucible Steel Company of America, Sanderson Brothers Works.

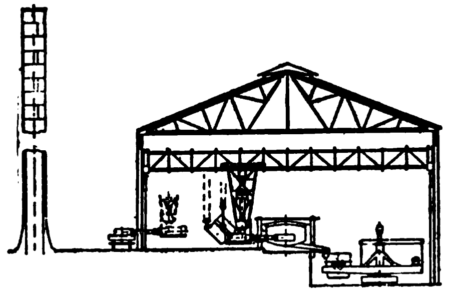
Steel — Open Hearth Manufacture. The process of producing steel of this class derives its name from the type of furnace used — an

Digitized by Google

open hearth. In European practice the process is known as the Siemens-Martin, receiving its name because of being originated, developed and perfected by two eminent and early metallurgists (1864–1867). The process is conducted either in an acid or basic furnace depending upon the character of the raw material treated.

There are several divisions of the process. The original plan was to treat a charge of all pig-iron with the assistance of iron ore to convert into steel. Later a modification was introduced wherein pig-iron and steel or wrought iron scrap were melted together and subsequently refined to steel. The first names constituted the Siemens process and the second the Siemens-Martin. To-day the essentials of either process remain, but modifications have been introduced from time to time. The Monell process, conducted in an open hearth furnace with a basic lining, consists of a charge of molten pig-iron to which certain quantities of iron ore and lime are added which fuse to form a slag and which slag flows out of the furnace at a point above the surface of the molten metal, thus carrying with it certain impurities in the charge of metal it is desired to remove. The ore and lime are added at certain intervals to make the overflow of slag continuous until the desired stage of purification is reached.

Next in importance is the Talbot Process, also conducted in a basic lined open hearth steel furnace. The furnace for this process is of movable type and is so constructed that the body can be tilted forward to discharge the bath of metal through an opening placed at the level of the bath, or it can be moved in the opposite direction to pour out of suitable openings placed at a higher point greater or less quantities of the slag. The process is a continuous one. A full charge of metal which may consist of molten pig-iron direct from the blast furnace, or a mixture of pig-iron and steel scrap is treated by additions of iron ore and lime until proper pre-determined conditions are reached by slag action. At that stage about one half of the refined charge is withdrawn into a ladle allowing the balance to remain in the furnace. At this point another addition of impure



Elevation Through Open-Hearth Furnace, Showing Charger and Locomotive Casting Crane.

molten pig-iron is poured into the furnace in sufficient quantity to equal the initial charge. The remaining slag is then removed by tilting the furnace, a fresh one made by ore and lime and the refining operation repeated. In the second treatment, however, the interval of time is considerably reduced because the residue of refined metal from the initial charge greatly dilutes the succeeding addition of molten impure stock and so making a smaller total of objectionable elements to remove by slag action. Under normal conditions the furnace is never empty excepting at week ends when incidental repairs are made. In regular open hearth practice the furnace is emptied completely at the end of each heat. It is then patched up, as may be necessary, and recharged.

Another modification of recognized importance is the Bertrand-Thiel Process. It is used in Europe to some extent. Two open hearth furnaces are used, one acid lined and another basic. One furnace may be placed at a higher level than the other so that the charge treated in the upper furnace can be tapped directly by gravity into the one below. Or the furnaces may be placed at the same level and the charge transference from one to the other be accomplished by ladles. The principle of the process is that a charge of impure stock is first

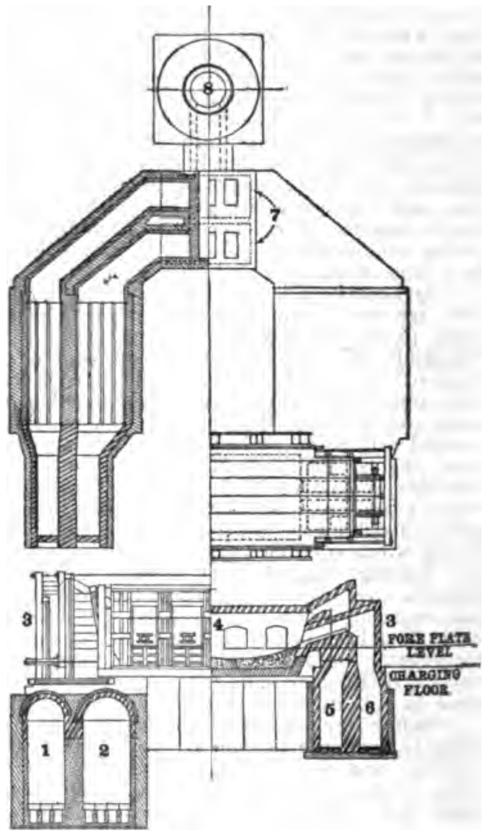


Fig. 1.— Plan and Elevation of Open Hearth Furnace Designed for Burning Producer Gas.

(1) Gas chamber; (2) air chamber; (3) ports; (4) melting chamber; (5) air up take; (6) gas up take; (7) base of reversing valves; (8) stack.

treated in an acid lined furnace to greatly lessen by nearly full removal certain elements objectionable to further purification by the basic process, by which the metal is treated and fully refined in the second stage of the process. It is a combined acid and basic process whereby pig-iron is converted to steel and allows the use

Digitized by Google

of such stock that could not be successfully refined by either process singly. In the acid lined furnace the charge of molten metal is de-siliconized and partly de-carbonized but not de-sulphurized or de-phosphorized, but when transferred after such treatment to a basic lined furnace, either by gravity or ladle, the de-carbonization, de-sulphurization and de-phosphorization are completed to meet any requirements. In the United States and Canada the Bertrand-Thiel process has, to some extent, been modified by the substitution of an acid bessemer converter to replace the acid open hearth furnace, the bessemerizing effecting the same action practically in regard to silicon and carbon removal from the charge which is subsequently transferred to a basic open hearth furnace for further purification and conversion to steel.

Construction of Furnaces.— The furnace is built on the regenerative principle. The waste heat of the spent gases from fuel consumption being absorbed and stored in chambers placed below the furnace body and at each end of it, can be utilized for pre-heating the air necessary to promote complete combustion of the fuel. Without such pre-heating it is not possible to depend upon flame temperature alone for melting and desired fluidity of the charge.

Reference to Figs. 1 and 2 will outline the general form of a stationary open hearth furnace. The furnace body or melting chamber is lined with high-grade refractory bricks. The whole is properly braced and supported by girders, tie rods and plates. In an open hearth furnace for the production of acid steel, the roof, hearth sides and end walls are constructed of silica bricks. The regeneration chambers are lined with fire bricks. The bottom of the hearth or pan is lined with silica sand over the silica bricks and dished or so formed that the metal when leaving the furnace through the tapping hole will flow and drain toward it. When a new furnace is ready to receive a charge the gradual preliminary heating up is of sufficient degree to harden the sand by slight fusion or sintering so that the hearth will preserve its shape and not be broken down by rough usage or attrition when receiving a charge of stock. In a furnace for the manufacture of basic steel, the roof walls, sides and end walls above the slag line are formed of silica bricks, but the hearth is lined in the pan with first quality fire-brick followed by bricks composed of magnesite, and at the junction of the silica bricks and the magnesite a neutral parting of chrome ore is placed to prevent fusion of the two kinds of brick at furnace-working temperatures. The upper courses of magnesite bricks will stand about 6" to 8" above the slag line. In other particulars of brick work the construction is the same in both classes of furnace.

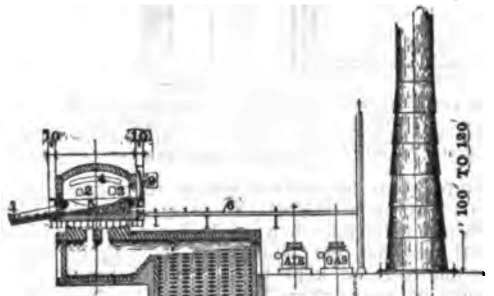


FIG. 2.— SECTIONAL ELEVATION OF OPEN HEARTH FURNACE.
(1) Spout; (2) gas port; (3) gas port; (4) air port; (5) hearth lining, sand for acid melting, magnisite for basic melting; (6) charging platform; (7) regenerator chambers with checkers — dark markings spaces between bricks; (8) flues leading to stack and from gas and air valves; (9) charging door; (10) buckstays and tie rods.

The various dimensions, areas and volumes of body, down takes and regenerator chambers vary mainly with the capacity of the furnace in regard to tons per heat or operation. The width of the furnace does not exceed 16 feet. The length and depth of hearth are not fixed, but the area of both closely follows certain values per ton. The length and depth of regenerator chambers will vary also, but the volumes as a rule closely follow figures per ton. Generally stated the following covers the various dimensions, etc.:

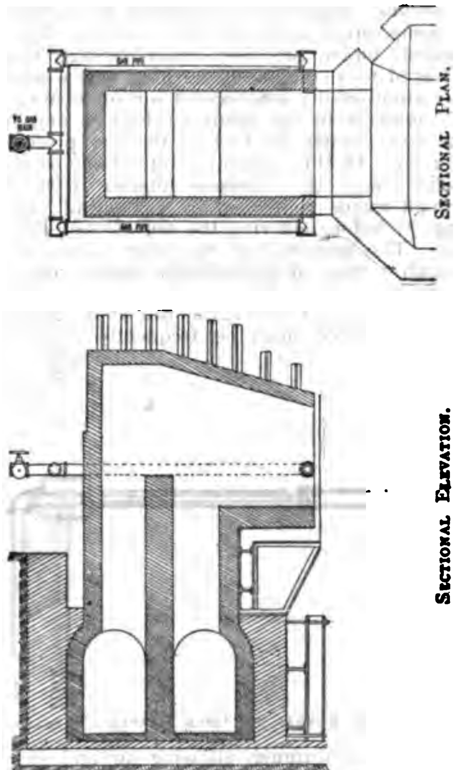


FIG. 3.— ARRANGEMENT OF FURNACE PORT FOR BURNING NATURAL GAS.

Hearth area, 9 sq. ft. per ton.
Chamber volume, 90 cu. ft. (1/3 for gas, 2/3 for air) per ton.

Air port area, 16 sq. ft.
Gas port area, 7½ sq. ft.
Stack, diameter 4-5 ft., 100'-160' height.
Producer area, 3½ sq. ft. per ton.

Fuel.
Coal, 700 to 1,000 lbs. per ton.
Natural gas, 800 to 1,000 cu. ft. per ton.
Oil, 60 to 100 gals. per ton.

Digitized by Google

The following figures represent hearth measurements for representative capacities:

Capacity	Length x Width	Hearth Area
30 tons	27 x 10 ft.	270 sq. ft.
50 tons	34 x 13 ft.	438 sq. ft.
200 tons	40 x 16 ft.	640 sq. ft.

The last item covers the dimensions of a Talbot furnace which has a deeper bath than other furnaces. The average depth of bath is 13″ while the maximum is 26″.

Fuel and Accessories.— The choice of fuel varies with the location of plants. In and around Pittsburgh natural gas is extensively used and is really the ideal fuel. It is not passed through the regenerator chambers but is fed directly into the furnace port (Fig. 3). It is regular in composition, possesses the highest calorific value and does not contaminate the bath. Next in heating value is crude petroleum or residuum, a by-product in the distillation of petroleum. Both have advantages in regularity of composition and ease of control. Oil is pumped, under pressure, from storage tanks delivered to a suitable oil burning device where it is atomized by compressed air or steam before ignition in the furnace (Figs. 4 and 5). The next source of fuel is the gas producer (Fig. 6). In this apparatus bituminous coal is gasified and the gaseous matter conveyed through mains controlled by regulating valves (Fig. 7) before entering the regenerator chambers. The principle of operation is to force through a mass of incandescent carbon air and steam. On top of the glowing coals fresh fuel is regularly fed to keep the bed at a constant level. The bed must be frequently poked to

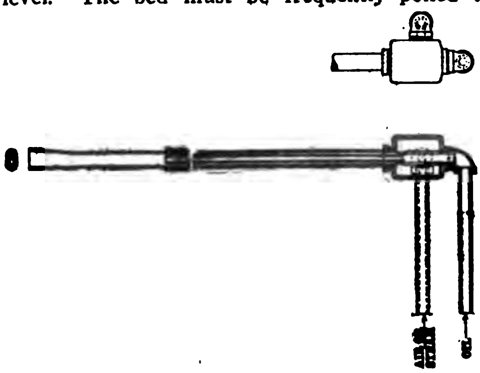


FIG. 4.— OIL BURNER FOR OPEN HEARTH FURNACES.

prevent holes forming, allowing air and steam to pass through un-decomposed. The bottom of the producer rests in a pan of water to prevent too much air to enter, since the air necessary to form a good working gas must be under control by passing through the blower. The gas is apt to vary in composition and is not not always regular in volume. A ton of coal will give about 160,000 cu. ft. of gas treated in a producer. The average composition is as follows:

Carbon Monoxide	27 per cent. by Vol.
Carbon Di-Oxide	5 per cent. by Vol.
Hydrogen	10 per cent. by Vol.
Nitrogen, etc., by diff...........	58 per cent. by Vol.

CALORIFIC VALUE OF FUELS.

	Per cu. ft.
Natural Gas....................	900 to 1000 B. T. U.
Oil..........16-1700 B. T. U. lb. or	913-760 B. T. U.
Producer Gas....................	130 to 140 B. T. U.

Furnace Operation — Acid Practice.— In order to produce steel by any open hearth process it is necessary that a certain amount of carbon be introduced with the metal to be converted. For that reason ordinary pig-iron is necessary which will contain 2.5-3.5 per cent of total carbon. The presence of carbon lowers the fusing point of iron and when charged in an open hearth furnace it is comparatively easy to liquify the bath at an early stage of the process and maintain it to the end of the operation. Low carbon stock, such as steel or wrought iron scrap, cannot be used singly because if exposed to flame action it would not fuse, but would be pasty and viscous, causing loss. The charge may be all pig-iron or a mixture of 20 per cent pig-iron and 80 per cent scrap.

The acid process designates the character of the hearth lining which is formed of nearly pure silica sand, a substance understood chemically as an "acid." It is fairly refractory but must carry a small percentage of foreign elements to very slightly lower its fusing point. In forming the hearth, as has been mentioned, it must be hard to resist wear and at the same time be inert under strong actions within the bath of molten metal at high temperature. It has no affinity for sulphur and phosphorous, but will fuse with oxides of iron or manganese. For the latter reason care is taken with heat

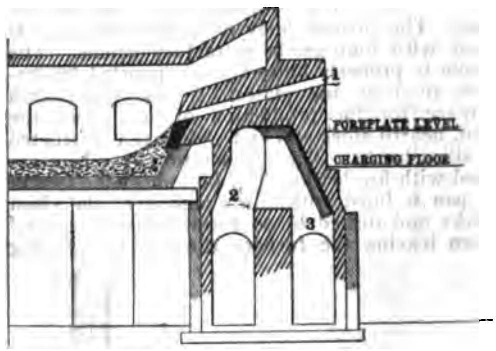


FIG. 5.— CONSTRUCTION FOR OIL BURNING OPEN HEARTH FURNACE. (Half Section at Centre.)
(1) Opening for oil burner; (2) air port from regenerator chamber: (3) air port from regenerator chamber.

manipulation to prevent undue scorification of hearth by such oxides. Since specifications for finished material, such as boiler plates, structural material, etc., state that the sulphur and phosphorous be kept below certain limits, the choice of raw material in regard to those elements are also subject to limits, and because of non-removal in refining whatever sulphur and phosphorus may be present in the initial charge will equal the finished product in like particulars.

Raw material for acid treatment is called "Acid Stock." and the following will represent average analysis:

Scrap Steel — S. 0.04% or less: P. 0.04% or less.
Pig Iron — C. 2.-3.5%; Si. 0.50-1.5%; S. 0.04% or less; P. 0.04% or less; Mn. 0.50-.75%.

The figures on C. Si. and Mn. for scrap are not specified because it is always the result of some previous converting process, and is therefore low in those elements. The shapes may be ingots, blooms, steel castings, tires, springs and

Digitized by Google

rolling-mill wasters. If scrap composes part of the charge it will be put in the furnace first followed by either molten pig-iron brought in a ladle direct from the blast furnace or iron in the forms of pigs. Before the iron addition some little time is allowed for the scrap to heat or melt partly. The chemical action is mainly a decarbonizing one or rather an oxidizing one. The first elements to oxidize are the silicon and manganese of the charge forming respectively silica (SiO_2) and manganese oxide (MnO) which fuse readily and unite to form part of the slag. The slag is mainly composed of SiO_2 and FeO. The FeO (ferrous oxide) being formed mainly in the melting of the scrap and the silica from sand carried in mechanically with the pig-iron and the oxidization silicon in the metals charged. The following analysis represents a normal acid open hearth slag:

SiO	52.00 per cent.
MnO_2	17.50 per cent.
FeO	28.50 per cent.

Under flame action the temperature of the bath is gradually increased mainly because the heat stored in the regenerator chambers and radiated to the air passing through them to support flame or fuel combustion increases the the efficiency. The checkers nearly fill both sets of chambers and are formed of first quality fire bricks so placed that numerous passages 3" to 3½" square are formed both vertically and horizontally, thus offering very large areas for the waste gases to pass through and give up

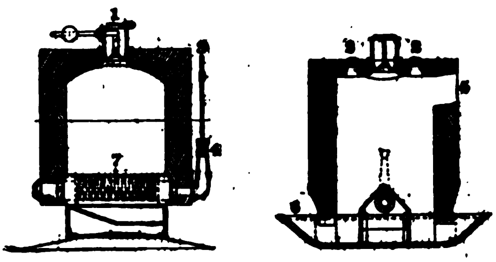


Fig. 6.— Gas Producer.
(1) Coal hopper; (2) poke holes; (3) steam pipe; (4) blower; (5) connection with gas main; (6) water sealed ash pan; (7) grate.

their heat to the numerous bricks. The waste gases leaving the furnace body are about 1100 to 1650 degrees C. and after passing through the chambers should normally measure about 5 to 600 degrees C. at the stack. At regular periods the course of the flame and gases are reversed so that while one set of chambers are giving up heat to the inflowing air or gas (Producer only) the other is absorbing the heat in waste products of combustion. Without a careful regulation of fuel there would be danger of melting the brick work in the furnace because with each reversal there is a constant increment of temperature carried into the furnace melting chamber.

The bath under increased temperature becomes very liquid bath in regard to the metal and slag. There is a lively action caused by the burning of the carbon which draws upon the oxygen in the slag and oxides dissolved in the metal. To hasten the removal of carbon, iron ore is added from time to time which produces the following reaction:

Carbon		Iron Ore		Carbon di-oxide		Iron
$6\ C.$	$+$	$2\ Fe_2O_3$	$=$	$3\ CO_2$	$+$	$4\ Fe.$

or

$$(1)\ C. + Fe_2O_3 = CO. + 2\ FeO$$
$$(2)\ FeO + C. = CO. + Fe.$$

The reduced metallic iron entering the bath, adding to the yield of metal while the gaseous carbon bubbling through the bath keeps it moving and so promotes homogeneity, an advantage in favor of any open hearth process. When the carbon removal has proceeded to any desired point as indicated by the fractured appearance of test pieces taken at intervals, the metal is tapped out of the furnace by breaking open the tapping hole with an iron bar previously closed, before charging, with some suitable refractory material. While the metal is flowing into a pre-

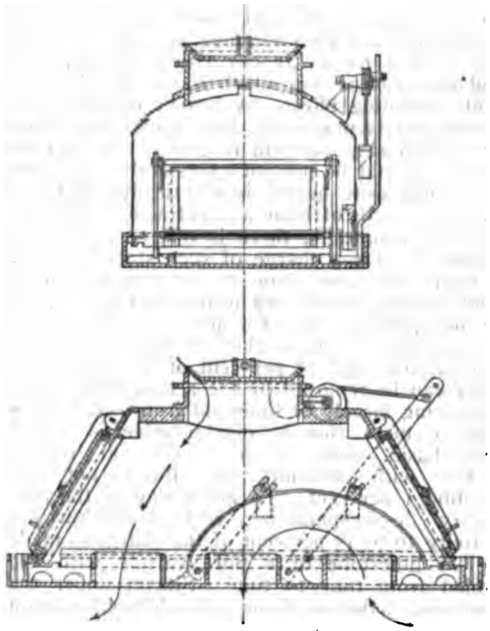


Fig. 7.— Forter Reversing Valve.
Arrows show direction of intake and outgoing gases. Arrow to left indicates: "To furnace through regenerator chambers." Arrows to right indicates: "From furnace through regenerator chambers to stack."

heated clay-lined ladle measured quantities of either spiegeleisen or ferro-manganese are added which have a cleansing effect upon the steel. They are alloys of iron and manganese each carrying respectively 20 per cent and 80 per cent of manganese with about 5.5 to 6.00 per cent of carbon. It is possible to stop the refining process at any time, and by using varying quantities of the substances just named known as de-oxidizers or recarbonizers, there is offered a possibility of producing numerous grades of steel. Without any additions of manganese at the end of an open hearth operation the metal would be charged with oxides and which would interfere with the rolling properties of the metal. The action of manganese is to liberate such oxides by making them readily fusible, float upward

Digitized by Google

and mingle with the slag above the metal. Metal not well de-oxidized is likely to crumble or crack when forged, rolled, hammered or welded.

After the steel is tapped into the ladle and from that into ingot molds (Fig. 8) they are stripped therefrom, and when the metal has solidified, the ingots are reheated and rolled out into various shapes.

Basic Practice.— To successfully conduct the basic open hearth process it is necessary to have a hearth lined with such material that will withstand the action of slags highly charged with lime. The presence of lime in moderate or excessive quantities in an acid furnace would be fatal to the hearth because of the strong fluxing action between silica and lime when brought together at high temperature. A basic lining in general practice consists of calcined magnesite, a substance carrying a high percentage of magnesia. In furnace construction it is ground and mixed with about 10 per cent of anhydrous tar, then rammed in and shaped to the sloping form. It can also be mixed with pulverized basic slag which assists the sintering and hardening effect. A hearth of magnesite so formed is practically inert under the action of a limey slag, but will fuse or cut if siliceous matter should be present excessively. The life of a magnesite hearth is practically indefinite. With a hearth of basic and refractory material, such as magnesite, there is offered an opportunity to treat a charge of such stock carrying a high content of elements not removed in an acid hearth; namely, pig iron with 1.00 per cent of phosphorous and 0.07 per cent of sulphur are easily treated, so that 95 per cent of the phosphorous and 75 per cent of the initial sulphur can be removed by the action of the slag, consisting largely of lime and iron oxide. The only element that is objectionable is silicon and basic stock or raw material is selected with amounts of silicon not exceeding 1 per cent. To get a slag of the necessary de-phosphorizing and de-sulphurizing activity 10 to 15 per cent of the charge is made up of limestone of a pure variety with ore added from time to time. Silicon under the oxidizing action of flame and additions of iron ore to the bath of liquid metal, will be converted to silica combine with the lime of the slag and if excessive rob it of its power to absorb phosphorus and sulphur. The details of charging are the same as in acid melting excepting that a charge is best made up of 50 per cent of pig and 50 per cent of scrap, when scrap is used, or the charge may be all direct molten metal. It is necessary to use scrap moderately because it is easier to promote liquation of bath with a higher carbon content initially.

The layer of supernatant slag is heavy in a basic heat and more heat units are required to penetrate it than an acid slag. For that reason the fuel consumption per ton is greater in the former than in the latter.

The flame manipulation is the same as in acid melting as is also the carbon oxidization by the action of iron ore. The details of recarbonizing are followed as in acid practice. During the progress of the heat samples are frequently taken which in addition to being studied for the carbon content, tests are also made to determine how far the de-phosphorizing action has gone. The heat is not tapped until its removal is complete or only a few thousandths of a per cent remain. There is

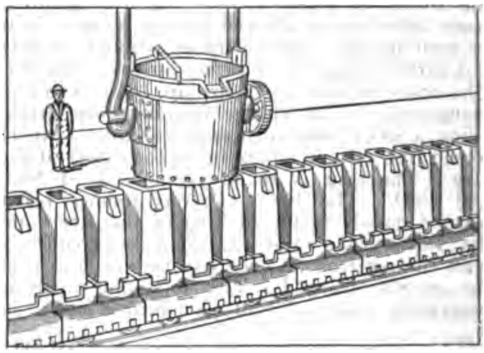


Fig. 8.— General Arrangement of Casting Ingots With Bottom Pouring Ladle.

some tendency on the part of the phosphorous to revert to the metal after it has been tapped into the ladle. The amount given up by the slag at that stage varies directly with the quantity of phosphorous charged initially. But with proper slag conditions and care in stock selection be observed the re-absorbtion of phosphorous is not excessive. Beginning with pig iron carrying 1 per cent of phosphorous and an equal amount of scrap with not more than 0.1 per cent a heat of basic steel can be produced to equal in analysis acid finished material.

When the furnace is emptied after an operation some unavoidable cutting of the hearth at slag line is patched with basic material of a cheap kind, usually dolomite, a double carbonate of lime and magnesia. There is not, under normal conditions, any cutting of the hearth below the slag line since the function of the hearth is only a refractory one playing no part in the purification of stock, that function being effected only by the calcerous slag.

In psysical properties for finished material such as axles, bridge material, boiler and ship plates, etc., no distinction is made between acid and basic steel.

In a 30-ton furnace it is possible to produce 18 heats per week of six working days. In a 50-ton furnace 15 heats per week is an average, either on acid or basic practice.

Steel Castings.— For marine, locomotive, freight, and passenger car, electrical and general machinery construction it is important to have certain parts of great strength and elasticity. For such purposes steel-castings are preferred to gray iron castings. In the United States the industry is increasing rapidly. The sources of supply are mainly divided between acid and basic open hearth steel with moderate productions by small bessemer and crucible processes.

During the year 1905 the total production was as follows:

Acid open hearth castings..............	320,381 tons
Basic open hearth castings..............	206,159 tons
Bessemer (Tropenas) castings, etc.......	22,103 tons
Crucible castings, etc..................	12,124 tons

Open hearth castings generally enter into heavy parts weighing several hundredweights to tons or more each, but do not enter into

Digitized by Google

parts weighing a few pounds. For lighter parts the bessemer and crucible processes fill a special field.

So far as quality and reliability of output is concerned in open hearth castings there is no choice between acid and basic steel. In the early history of the processes (open hearth) the acid held sway, but with the development of the basic process it has largely met the growing demand for steel castings in spite of the fact that at first basic steel was more uncertain in its qualities.

For the production of open hearth castings the details of construction and operation are essentially the same as for ingot practice. The main differences are that direct molten metal is not used, the charges being made up of cold raw material (pig iron and scrap). The sizes of furnaces vary from 10 to 25 tons per heat.

In the manufacture of steel castings problems are encountered which are unknown in ingot practice. It is comparatively simple to pour liquid steel into such receptacles as ingot moulds but when pouring it into sand moulds designed to cast shapes more or less intricate with various thicknesses of metal, greater or lesser length and irregularities of section than is found in the plain columnar lines of ingots the complexites become quite numerous. The common difficulties encountered are lack of solidity, liability of the castings to crack or separate when cooling, particularly in complicated designs where there may be different rates of cooling in sections of unequal thickness. These difficulties are not insurmountable, but their avoidance calls for constant care and watchfulness and a high degree in skill in keeping conditions regular and uniform in the furnace melting practice, and also in the moulding and coring of designs.

For moulding purposes a high grade silica sand is preferred, one that is highly refractory and that will not fuse at the temperature of liquid steel 15 to 1600 degrees C. An impure sand will stick to steel castings and make rough unsightly surfaces. The sand must be of such a formation so that there will be voids between the grains to permit a free escape of the gasses formed within the mould when the hot steel is poured into it. Silica sand is devoid of any bond, and, to allow it to retain the form of the pattern after the sand is rammed around it and the pattern withdrawn, a small amount of plastic fire clay is added to the sand with a little water, followed by thorough mixing to furnish the necessary bond or stability to the moulding mass. Sometimes a mould is baked, or it may be used without any drying. The first is known as "dry sand" and the other a "green sand" practice.

When the mould is filled with the liquid steel the moulding mass under the high temperature disintegrates or loosens and should allow a free movement of the casting which contracts when cooling. Should there be a resistance to such a movement in cooling the casting will be liable to crack at points when the resistance and stresses are the greatest.

To promote solidity in steel castings it is the practice to add at the end of the refining and de-carbonizing operation certain amounts of ferro-silicon and ferro-manganese. The former may carry from 10 to 50 per cent of silicon and the latter usually about 80 per cent manganese. The combined action of the alloys is to thoroughly de-oxidize the steel by uniting with the dissolved oxides, flux them so that they become separated from the liquid steel and enter the slag on top of the bath of metal. Were the oxides not removed there would continue, so long as the metal remained liquid, a reaction between them and the small quantity of carbon always present in a bath of liquid steel, so that there would result a formation of gaseous carbon. Without a stoppage of that action the metal, if fractured when cool, would be found to be more or less honeycombed — an undesirable condition in any casting.

The value of a steel casting, physically considered, depends upon its elasticity, toughness and ability to resist heavy duty. The elasticity is controlled by the carbon content of the finished casting and that will vary with the requirements of its service. Steel castings are divided into three grades: Soft, medium and hard. Standard specifications give the following figures as the physical properties:

	Soft	Medium	Hard
Tensile strength lbs. per sq. in.	60,000	70,000	85,000
Field point (elastic limit) lbs. per sq. in.	27,000	31,500	38,250
Elongation per cent. in two in.	22	18	15
Contraction of area per cent..	30	25	20

Approximately the following will represent the ranges of chemical composition for the foregoing:

	C. %	Si. %	S. %	P. %	Mn. %
Soft	0.17-20	0.25-35	0.015-0.05	0.020-0.04	0.5-0.75
Medium	0.20-30	0.25-35	0.015-0.05	0.020-0.04	0.5-0.75
Hard	0.30-40	0.25-35	0.015-0.05	0.020-0.04	0.75-1.00

In order to increase the ductility of castings, the ability to resist shock or impact without fracture, they are subjected to an annealing process, which treatment consists of a careful heating to a temperature that lessens original cooling stresses and refines the grain of the metal. In a steel casting cooled from casting temperature there is a tendency of the crystals to become enlarged, and with that condition the metal may be of a doubtful value, since a coarse internal structure is more or less brittle, but by heating to a temperature to or about a full cherry red the coarse crystals become broken up and replaced by ones of much smaller formation. With that internal structure the ductility of the metal is greatly improved by removing all previous brittleness. The refining temperature varies with the carbon content of the steel to be treated. The higher the carbon the narrower the ranges of temperature for refining. The lower the carbon the temperature need not be so closely observed. It is a rule, however, that with the proper temperature being known, the heating below the refining range does not accomplish anything in changing the crystalline formations. Too high a heating will cause the crystals to grow in size. The length of time in heating a steel casting to anneal, varies directly with the section, but after the piece has reached the proper temperature the fire can be drawn.

The location of the refining ranges can best be determined by a pyrometer and a microscope to study the various degrees of crystalline structures which reflect the rates of cooling from various temperatures.

Digitized by Google

With the carbon content given to control the tensile strength and elasticity, usually one half of the tensile strength, the maximum degrees of toughness in any grade of steel casting can only be obtained by careful heat treatment or annealing.

The other elements, Si, S, P and Mn, have various properties in influencing the character of the product. An excess of any one tends to interfere with the best results in service. Long practice, however, has established certain ranges of composition being suited to both producer and consumer as set forth in the preceding tabulations.

W. M. CARR,
Member British Iron and Steel Institute, American Foundrymen's Association, American Society for Testing Materials.

Steel — Special or Alloy Steels. Steel has been defined as a malleable alloy of iron and carbon which has been produced by casting from a fluid mass. It is intermediate as regards its carbon percentage between wrought iron and cast iron. It differs from the former essentially in that it is homogeneous in composition and free from entangled slag. It differs from cast iron in that it is malleable and can be readily rolled. In addition to iron and carbon there are four other elements present in ordinary steel whose effect must be considered: they are manganese, silicon, sulphur, and phosphorous. These are often considered as impurities, since it is almost impossible to make steel free from them. The former two elements, however, especially manganese, must be considered essential and beneficial, while sulphur and phosphorus are nearly always unwelcome guests. Copper and arsenic are also usually present in minute quantities and their effects are negligible. Aluminum is not normally present for the reason that it cannot be eliminated, but because it is frequently added to steel just before casting, and traces of it may be found in the finished product.

Ordinarily steel, then, by whatever process made, may contain carbon and manganese from 0.10 to 1.50 per cent; silicon from 0.02 to 0.25 per cent; sulphur and phosphorous from 0.01 to 0.10 per cent; and copper, aluminum, and arsenic in negligible quantities. It usually contains hydrogen, oxygen, nitrogen, and cyanides in minute amounts.

Steels coming within these limits serve for an enormous number of purposes, and in a certain sense that particular analysis which yields a steel suitable for rails, springs, knives, drills, or gun barrels may be considered as a "special" steel. Such is not the commonly accepted significance of the terms "alloy" and "special" steels. Although all steel is an alloy, by common consent we consider steel almost as though it were a chemical element — as though it were a simple substance, instead of an alloy of from two to ten constituents. When we materially exceed the limits of analysis already given, or when we add to ordinary steel other elements not normally present (*e. g.*, nickel, chromium, vanadium, tungsten, molybdenum, or titanium), either by intent or chance, the product is an "alloy" or "special" steel. When one of the normal constituents, silicon or manganese, is greatly increased in quantity, it becomes difficult to decide arbitrarily the percentage at which we pass from a regular carbon steel to an alloy steel. Abnormally raising the ordinary constituents or adding other constitutents so alter the properties of the resulting alloy that many useful purposes are served, and results not otherwise obtainable are secured. We thus see why the term "alloy steel" has acquired a special significance, meaning any steel to which, in addition to iron and carbon, and the impurities common to all steel, other metals or metalloids has been purposely added to change or improve its natural properties. Chemically pure iron may properly be classed among the "rare metals." An able-bodied man would not be burdened with all the *pure* iron that was ever made, while the production of commercial iron products, more or less impure, amounts to millions of tons annually.

Not only is steel a very complex material, but its complexity is further increased by the allotropic character of the element iron, and by the fact that the carbon may exist in several different chemical conditions or combinations, while the same is probably true of the sulphur and phosphorus.

In cooling pure iron from a molten condition, Roberts-Austen found that its freezing point is about 1,600° C. All of its alloys with carbon up to 4.3 per cent melt at increasingly lower temperatures down to 1,130° C. Below the initial solidifying point of pure iron there are two other temperatures at which cooling momentarily stops. These temperatures are 895° C., designated as Ar_3, and 765° C., designated as Ar_2. When carbon is present a third very-well-marked arrest of cooling occurs at 690° C., known as Ar_1, the ordinary "recalescence" point. Carpenter has determined the melting point of pure iron as 1,500° C.

It is believed by many that the molecular transformations occurring at Ar_3 and Ar_2 indicate allotropic changes in the iron itself. At temperatures above Ar_3 we recognize the gamma-iron of Osmond, non-magnetic and a solvent for both elemental carbon and iron carbide. Between Ar_3 and Ar_2, iron exists in the condition designated as beta-iron, also non-magnetic, but not a solvent for free or combined carbon. Below Ar_2 iron exists in its magnetic condition, known as alpha-iron, in which iron carbide is not dissolved or only slightly.

There are many who do not accept the allotropic theory; but whatever significance these critical points may have, all concede that they do occur, and that at certain critical temperatures the character of the iron undergoes profound changes. Those who do not admit the allotropy of iron neither dispute the allotropy of carbon nor its occurrence in iron in at least two conditions — free, as graphite, and combined, as iron carbide, and it is generally supposed that this combined carbon may exist in steel, either in isolated particles or in a dissolved state. By means of these hypotheses or facts in regard to iron and carbon, we can explain many things which were but recently veiled in mystery and speculation. For this knowledge of the constitution of steel we are indebted to many of the world's ablest chemists and physicists.

Digitized by Google

In general, it may be said that the influence of other elements upon iron-carbon alloys is (1) to change the critical points; (2) to modify the condition in which the carbon occurs; (3) to remove harmful occluded gaseous impurities; (4) to combine chemically with the iron or carbon, or both; and (5) either combined or free to form isomorphous solutions with the iron or to separate into distinct microscopic particles. In thus deporting themselves these other elements are found to improve or injure the steel; to make it harder or stronger; more ductile or more brittle; a better magnet or a better tool. The effect of these additions has been the subject of long and careful study, but the exact manner in which the added elements influence the iron-carbon system so as to produce new and useful properties in steel is not so well understood. These deeper questions are being studied by a host of able investigators, and every day new truths are discovered, which, it is hoped, will soon form a basis for rational and intelligent experimentation in revealing the hidden possibilities of the iron alloys.

Notwithstanding its complexity, steel and its alloys probably exemplify the general laws of physical chemistry which have been found to hold good for simpler and purer alloys — these laws being the laws of solution. Thus Roberts-Austen and Spring found that one metal diffuses into another like a salt into water; in general solubility increases with the temperature. Metals and alloys will flow under pressure. Under 200,000 pounds pressure, the writer obtained from a 3.50 per cent. nickel steel cylinder, two inches high by one inch in diameter, a shortening of over 50 per cent, the new top and bottom diameters being one and a quarter inches, while the centre bulged to over one and a half inches diameter, and there were no signs of cracking under this great pressure. Alloys may or may not react chemically when brought into intimate association by fusion or pressure; the molecular mobility increases with the temperature; upon cooling of molten alloys phenomena strongly suggestive of freezing salt solutions are observed; the depression of the freezing point of a metal when another is added to it follows the laws of Coppet and Raoult, for dilute solutions, and finally, the phase rule, of Gibb, applies quite as well to the explanation of conditions of equilibrium in alloys as to similar problems in regard to liquid solutions.

Benedicks' work on electrical conductivity of steels, shows the chemical equivalence of the atoms of different elements dissolved in iron in increasing the resistance, and in one particular instance, that of molybdenum and tungsten steels, long practical experience has shown that these metals are effective in about the proportion of their atomic weights; that is, one part of molybdenum is about equal to two parts of tungsten in self-hardening and high speed steels, and the writer has fully demonstrated that the same relation holds as regards the magnetic qualities of hardened molybdenum and tungsten steels.

The Chemical Constitution of Steel Alloys. — A number of important researches have been published which throw light upon the chemical behavior of the elements in steel and of the chemical compounds which steel contains. Iron and carbon are known to combine at least in one combination, Fe_3C, and many other carbides of doubtful existence have been mentioned from time to time. Manganese seems to form an isomorphous solution with iron, and lowers the critical points. When over 12 per cent manganese is present the temperature of transformation known as Ar_1 is below 0° C. Manganese prevents the separation of graphite, and thus raises the saturation point of iron for carbon. In its direct chemical affinities it seems to unite readily with several elements; it forms a carbide, Mn_3C, analogous to cementite, and it unites with phosphorus, giving a phosphide, Mn_3P_2.

Phosphorus unites also with iron to form the phosphide, Fe_3P. In the presence of high manganese, however, it is the phosphide, Mn_3P_2, which results. Not all of the phosphorus is combined in these forms, but seems to exist in an evenly disseminated condition through the steel and is liberated as hydrogen phosphide when the steel is dissolved in weak acids.

Sulphur occurs in steel as manganous or ferrous sulphide, MnS or FeS; but there may be present small amounts of copper, titanium, or other sulphides, and these are not decomposed by hydrochloric acid in the usual evolution methods for determining sulphur in steel. Of the sulphur liberated, not all exists in the form of hydrogen sulphide, but, as shown by Schulte and Phillips, a portion is liberated as methyl sulphide $(CH_3)_2S$.

Chromium occurs both dissolved in the main mass of the iron and also combined in the form of various double iron-chromium carbides which are not easily attacked by acids.

Silicon in ordinary amounts is wholly dissolved in the iron. Molybdenum and tungsten are said to combine directly with iron giving true intermetallic compounds and also to form more or less complex carbides.

Nickel forms isomorphous mixtures with iron in all proportions. Copper is dissolved in large quantities by iron without the formation of any compounds. Manganese in excess above that uniting with phosphorus behaves like nickel; titanium in excess is believed to act similarly, but it is reasonable to expect that it would unite with both sulphur and nitrogen if they were present in the steel. Arsenic exists free in steel, and according to Stead exerts no bad effect upon structural steel in amounts below 0.15 per cent. In hardened steel the arsenide of iron occurs.

Electrical Conductivity of Steel Alloys. — Several years ago Prof. Barrett of Dublin, Dr. Benedicks of Upsala, Sweden, and Dr. Mathews observed independently and at about the same time, that there was a connection between the resistance offered by steel wires to electric conduction and the atomic weight of the elements present in the iron. This again calls attention to the close relation existing between alloys and ordinary solutions. Prof. Barrett's paper points out a relation between increased resistivity and the specific heat of the added element. But when we recall that *specific heat* $\times$ *atomic weight* $=$ *a constant*, we see that the increased resistivity is as closely connected with the atomic weight as with specific heat.

In studying the relation of electrical resist-

Digitized by Google

ance to the constitution of the conducting alloys, the complex character of steel must be kept in mind. It has already been pointed out that steel always contains carbon, manganese, silicon, sulphur, and phosphorus; that the iron may exist in two or three modifications, and that carbon may also exist in a variety of ways. The limits of solubility of various elements in iron are in most cases unknown, and the intermetallic compounds of iron with another metal, or of two metals with carbon forming a double carbide, have been but imperfectly worked out. Yet, not withstanding these complications, a broad view of existing evidence leads to the belief that the atomic law is in some way connected with the problem.

Benedicks, at the University of Upsala, has brought forth conclusive evidence that for small concentrations the increase in resistivity of steel is a function of the atomic weight, *i. e.,* equi-atomic solutions of metallic elements in iron produce equal increase in electrical resistance. Benedicks determined the electrical resistance of a number of samples of steel which had been carefully analyzed. They contained varying quantities of carbon, silicon, manganese, sulphur, and phosphorus, the last two elements being fairly low and uniform. The steels were tested in both the hardened and annealed state. From his determinations he found that one atomic per cent of various elements dissolved in iron produces an increase in resistance which is equal to 5.9 microhms per centimetre cubed. He also calculated that the resistance of absolutely pure iron would be 7.6 microhms per centimetre cubed, but this value is lower than has ever been obtained experimentally, for perfectly pure iron has not been investigated. By means of a formula it was found possible to calculate the resistance of steel with considerable accuracy, when its analysis was known. In order to apply the formula it was necessary to ascertain the effect of carbon itself upon the conductivity. This Benedicks has done very skillfully. In annealed steel the carbon for the most part exists in separate particles of cementite, Fe_3C. When steel is heated to a temperature above 720° C. and suddenly cooled, this cementite disappears and the structure known as martensite results. The carbon of martensite may be combined or simply dissolved without combination. However, when hardened steel is reheated and slowly cooled, cementite again appears, accompanied by ferrite. This ferrite has usually been considered to be pure iron, and ferrite and cementite when existing in alternating bands constitute pearlite. Benedicks shows that ferrite is not free from carbon, but that annealed steels containing from 0.40 per cent to 1.70 per cent carbon consist of cementite and iron which contain about 0.27 per cent dissolved or hardening carbon. According to Benedicks, the carbon segregated in the free cementite exerts little influence upon the conductivity. Le Chatelier, however, gives the resistance of ferrite as 9.5 and cementite as 45. Benedicks' work thus confirms the chemical researches of Osmond and Werth, Carnot and Goutal, Brustlein, Arnold, and Stansfield in regard to the existence in annealed high-carbon steels of 0.27 per cent of hardening carbon in solid solution. The writer is of the opinion, that, in the separating or crystallizing out of the constituents of any alloy, no pure metal ever separates, but metal containing more or less of the other constituents of the alloy in solid solution.

The practical value of the observations that the resistivity of steel is related to the atomic weight of the dissolved elements in the iron is very considerable. As Barrett has mentioned, knowing the carbon contents of a piece of steel, its relative content of other elements may be judged by determining its conductivity. Benedicks' work makes it possible to judge the electrical quality of different samples of iron by a study of their composition without testing them at all. Barrett has also called attention to the fact that physical hardness has nothing to do with high resistivity. That is, for equal percentages of impurities hard tungsten and manganese steels conduct better than soft aluminum and silicon steels. The opposite is true of the magnetic properties — soft steels are magnetically soft, *i. e.,* highly permeable, while hard steels are magnetically hard, of low permeability, and greater retentiveness.

High Speed Steels.— A great variety of steels of the class known as self, or air-hardening, have been put upon the market within the past few years. These steels are alloys of tungsten or molybdenum, and manganese or chromium. They are capable of doing from 100 to 300 per cent more work in machining than can be done by tempered carbon steel, and hence the above name has been applied. Their greatest use is in making roughing cuts either in the lathe or planer; for finishing cuts they are not equal to the best tempered tools.

Hardened high carbon steel for metal working has its output limited by the fact that in removing chips from the piece being machined most of the work is transformed into heat at the point of the tool, which consequently loses its temper at that point. Under normal working conditions the heat generated at the toolpoint is conducted and radiated away to such an extent that the temperature is maintained uniform and proportional to the speed of the cutting. The output of a tool depends upon its strength and upon the heat that it can endure without losing temper. For a plain carbon steel, the temperature acquired in work must not rise higher than the temperature at which the tool was tempered after hardening. Rex, Novo, Mushet, and many other steels are now made which will hold a cutting edge at a temperature more than twice as high as any plain carbon steel, and this means that the speed of lathes for roughing cuts can be increased from one to three times the usual limit. Thallner recommends very high speed with limited depth of cut, rather than a very deep cut and low speed. The former condition is the more economical.

The adoption of high speed steels in large shops has revolutionized this kind of work and has necessitated the installation of more power and heavier machinery. The contest between the makers of lathes, planers, etc., and the makers of high speed steel reminds us of that which has gone on for years between the makers of armor plate and of projectiles. Certain it is that shops with little available power and slowly-geared and light lathes cannot profit

Digitized by Google

much by these recent metallurgical achievements. For roughing cuts, such as axle turning, a man can double or triple the output per day formerly expected of him. High speed steels are used also in wood turning, and with the same good results. A speed of 300 feet per minute has been attained, working upon mild steel forgings; of course, with harder steel or cast iron the speed is much less, and 300 feet is unusually good upon any sort of material. The number of steels now on the market, all of which lay claim to the possession of properties suiting them to high speed work, is very large. They are not all of equal merit, but at the same time it is an interesting study to compare the analyses of these steels, and to see in how many different ways different makers seem to accomplish their ends. Their compositions are nearly as numerous and as different as those of bearing, or so called anti-friction metals. Analyses of these cannot be given here, but we may state some of the limits met with in actual experience, or covered by patents: Carbon, 0.3 to 2 per cent; tungsten, 0 to 25 per cent; silicon, 0.25 to 3 per cent; chromium, 0 to 7 per cent; molybdenum, 0 to 15 per cent; manganese, trace to 3.9 per cent. Sulphur and phosphorus always low. Usually three of these elements are present in quantities which show them to have been intentionally added.

Special Properties of Some Steel Alloys.— The alloys, with some of the rarer metals, will now be mentioned so far as reliable information concerning them is to be had, and recent scientific work upon alloys, which has been productive of practical results, will be briefly considered.

Silicon has proved itself to be an advantageous addition to steel for a variety of purposes. Casper and Oertel have patented in Germany a chrome-silicon steel, the silicon being greater, less, or equal in quantity to the chromium. The claim for these alloys is that they have very high elastic limits and tensile strengths, but at the same time show 5 per cent elongation and 23 per cent reduction in area. When hardened and tempered they are said to be exceptionally good for machine parts, weapons, wire rope, and springs. In general, silicon up to 0.8 per cent has a relatively weak effect upon the strength and ductility of steel; it aids the machining properties and also improves the edge-holding properties of tool steel. When high in amount it becomes injurious to annealed steel because it tends to cause a separation of graphite, as may be noticed from the dark appearance of the fracture. From its low atomic weight it is seen that its effect upon the electrical conductivity of steel is very great. In low carbon steels it seems to exert a beneficial effect upon the magnetic permeability. Recently as high as 3 per cent silicon has been observed in certain high speed steels, and Jacob Holzer & Co. (Unieux) have patented a new spring steel of the following composition: Si, 1.8 to 2.2 per cent; C, 0.35 to 0.45 per cent; Mn, 0.45 to 0.55 per cent. This steel is hardened at the unusually high temperatures of between 900° and 1,000° C. Silicon raises and causes to disappear Ar_3, lowers Ar_2, and slightly raises Ar_1.

Vanadium imparts to steel an increased tensile strength and elastic limit, and when [illegible] It is [illegible] ness in [illegible] There [illegible] vanadium and [illegible] land seems to [illegible] products. The [illegible] together with its [illegible] oxidization, both of [illegible] troublesome to add to [illegible] use of this metal [illegible] mental state. Ferro-[illegible] cent and not over 1 per [illegible] per cent silicon is best [illegible] making. It is not apparent [illegible] hand that these small quantities of [illegible] vanadium confer any advantage [illegible] from the addition of from 7 to 10 [illegible] much low-priced nickel. The greater [illegible] the vanadium literature seems to [illegible] supplied by the makers of ferro-vanadium. The writer has carefully investigated the use of vanadium in plain carbon steels, nickel, chromium, and nickel-chromium steels and finds that vanadium greatly increases the elastic limit and tensile strength and hardness, but the capacity for bending or twisting, the elongation and reduction of area, and the ability to resist shock (Fremont test), are all decreased by vanadium, even when present in amounts below 0.25 per cent, in steels tested in their natural rolled condition, annealed or oil-hardened and annealed.

Nickel steel has long been in use, but its possibilities do not seem to have been exhausted either from the standpoint of practical utility or from that of theoretical interest to students of the molecular constitution of alloys. Nickel lowers the critical points, especially Ar_1. When 25 per cent of nickel is present Ar_1 is below 0° C.; it occurs, however, if artificial cooling be employed. In connection with this phenomenon it is interesting to note the microscopical researches of Guillet, who experimented with three series of alloys containing respectively 0.12 per cent, 0.35 per cent and 0.85 per cent carbon, the nickel increasing by steps of 2.5 per cent up to 30 per cent. The etching was done by alcoholic picric acid. Guillet found that as the nickel increased pearlite was replaced by martensite, and this in turn by polyhedral crystals indicative of gamma-iron.

Guillet's results upon the microstructure of nickel steels in general show that mild steels up to 10 per cent Ni. are like plain carbon steel; between 10 to 15 per cent Ni. there is a hardening effect; from 15 to 21 per cent Ni. they are very hard because chiefly composed of martensite; beyond this amount of nickel they again become soft because martensite is replaced by gamma-iron. The higher the carbon the less nickel is required to produce these structural changes.

Nickel steels melt at a lower heat than the corresponding carbon steels; there is less segregation or liquidation in them, and hence such steel is suitable for castings on account of its homogeneity. There seems also to be less tendency to form blowholes. Nickel steel forgings though tough are not difficult to machine, from 3 to 3.5 per cent Ni. in a 0.25 per cent C. steel gives a tensile strength and elastic limit equal to a 0.5 per cent C. steel

Digitized by Google

but still retains 25 per cent elongation. At the Düsseldorf Exposition a Krupp armor plate of nickel steel weighing 106 tons, and made from a single ingot of 130 tons, was exhibited. Nickel steel shafts containing up to 3.6 per cent Ni. are forged by this firm by hydraulic pressure. One of their presses is of 5,000 tons pressure.

Guillaume has discovered that the 36 per cent Ni. alloy expands only 0.000001 mm. per 1° C. or only one-twelfth as much as pure iron. This property has suggested its use in pendulums, measuring rods, chronometers, etc., and its non-corrosive nature makes it still more valuable for such uses. It is also adaptable to marine, boiler, and general structural purposes. Theodolites, leveling instruments, and other apparatus of the United States Coast and Geodetic Survey are to be made of this alloy. Another very important application of nickel steels is suggested by the anomalous expansibility of this alloy. By adding either iron or nickel to it, alloys of almost any degree of expansibility result. An alloy having the expansibility of glass may be produced to replace platinum in incandescent lights. This alloy is actually in use, and it is hoped that its extended use may reserve more of the world's platinum supply for the use of laboratories, and at a lower price. Charpy and Grenel have shown that an alloy containing 36.1 per cent Ni., 0.39 per cent C., and 0.39 per cent Mn., not only has an extremely low coefficient of expansion, but that it is practically constant between 15 and 200° C.

Manganese steel is in some respects analogous to nickel steel. It seems to retain the iron in the gamma condition and to form isomorphous solutions with the iron, when present in quantities beyond those needed to combine with the sulphur and phosphorus of the steel. Nickel (25 per cent) gives an alloy which is practically non-magnetic; but when cooled strongly becomes powerfully magnetic and remains so when warmed up to the normal temperature. Hadfield's manganese steel containing 13 per cent manganese and 1 per cent carbon is but slightly magnetic and the amount is nearly constant for strong or weak magnetic fields. There is no appreciable residual magnetism.

It may not perhaps be considered remarkable that manganese,— a non-magnetic metal, should destroy the magnetic qualities of iron when alloyed with it to the extent of 12 or 13 per cent, but surely it is quite unexpected to find a nickel steel, of 25 per cent Ni., almost non-magnetic, since iron, nickel, and cobalt are the only strongly magnetic metals. Non-magnetic alloys of magnetic metals while hardly to be expected are not more remarkable than the magnetic alloys of Heussler, made of non-magnetic metals and containing no iron, nickel, or cobalt. An alloy of copper (60 per cent) manganese (25 per cent), and aluminum (15 per cent). will be found as strongly magnetic as cast iron. While steels of 10 to 15 per cent nickel are brittle and manganese steels of 3 to 8 per cent manganese exhibit the same property in a greater degree, a combination of nickel and managanese in the proportions of 15 and 6 gave Hadfield his "Resista" alloy, celebrated for its toughness. A two and one-half inch cast bar of this alloy has been bent double cold. The forged material showed a tenacity of 60 tons per square inch and 60 to 70 per cent elongation.

Titanium seems to increase the ductility of steel and raises the elastic limit very considerably. Its use is not very extensive, however. Titanium combines chemically with nitrogen and thus possibly improves the quality of steel by removing from it occluded nitrogen. For alloys of very closely corresponding compositions Rossi finds an increase of from 16 to 100 per cent in elastic limit, the increase being greater in proportion as the carbon increased. The ultimate strength tests did not show such great differences, but still they were very marked, while the contraction and elongation was always very highly in favor of the titanium steel. These effects in most cases were stated by Rossi to have been due to the presence of 0.10 per cent Ti.

Boron as a constituent of steel is frequently mentioned in foreign journals, but is rarely met in commercial steels. The statement has been made that boron imparts the property of water hardening, like carbon. Charpy and Moissan deny that boron causes hardening in the ordinary sense; it does raise the tensile strength when quenched.

Bibliography.— See monographs of Hadfield, Riley, Stead, Roberts-Austen, Carpenter, Gledhill, and others in the 'Journal of the Iron and Steel Institute'; Guillaume, Guillet, Le Chatelier, Osmond, Charpy, and Carnot in 'Revue de Metallurgie and Comptes Rendus; also files of the 'Metallographist' and 'The Iron and Steel Magazine,'— all the above during the past decade. Mathews, 'The Mineral Industry' (1903, p. 671); 'The Fifth and Sixth Reports of Alloys Research Committee of the Institute of Mechanical Engineers' (1809 and 1904); Carnot and Goutal, 'Annales des Mines' (1900); Barrett, 'Scientific Transactions of Royal Dublin Society' (VII, p. 67), and 'Proceedings of the Royal Society' (LXIX, p. 480); Benedicks, 'Zeitschrift für Physicalische Chemie' (XL, p. 545); Mathews, 'Electrical World and Engineer' (1902. p. 531), and 'Engineering and Mining Journal' (1901); 'Report on Taylor-White Process of Treating Tool Steel' ('Journal Franklin Institute,' 1903); Rossi, 'Transactions American Institute of Mining Engineers' (XXII); Guillet, 'Les Aciers Spéciaux' (4 vols.); Howe, 'Iron, Steel, and Other Alloys' F. W. Taylor, On the Art of Cutting Metals, Proceedings Amer. Inst. Mechanical Engineers, 1906.

JOHN A. MATHEWS,
Assistant Manager, Crucible Steel Company of America, Sanderson Brothers Works.

Steel — The Evolution of Steelmaking Processes. In prehistoric times the earth's inhabitants fashioned their implements from flint. After a time, as the result of observation or chance, primitive men discovered that metals, such as copper and lead, could be obtained from certain earths or ores, and it was not long until they found that copper could be made harder by the addition of a little iron, arsenic, or tin. That they ever actually hardened copper, in the sense that we harden steel for tools, is extremely improbable.

It is not easy to say whether the bronze age preceded the iron age or not, and if it did, by

Digitized by Google

what period. Flint instruments and weapons are almost imperishable, bronze is very enduring, while iron rusts, and if buried in a damp place is wholly converted into hydrated oxide or carbonate of iron, soluble in waters containing much organic matter. For this reason iron relics of great age are scarce, while flint and bronze fill the museums. However, in certain ruins of the Swiss lake dwellings all three sorts of implements were found, flint, bronze, and iron. It seems probable that the first iron used was of meteoric origin.

The use of iron is frequently mentioned in the early books of the Old Testament. The Egyptians were familiar with it at least 4,000 years ago. The Assyrians probably knew how to obtain iron from its ores and how to fashion it into saws, chisels, etc., at a still earlier date than the Egyptians. The various ages known as the stone, bronze, and iron ages are not fixed periods in the world's history, but are periods in the history and development of individual tribes and nations. For example, while at a period, say 1,000 B.C., the Egyptians and Assyrians were making swords of iron (and a cross-cut two-handed saw of this period is in the British Museum) the bronze age existed in Southern Europe, while in the Northern and Western Europe wood and stone implements were in general use. In India, China, and Japan there is abundant evidence of the manufacture and use of iron at a very early period. In this very day there are tribes in Central Africa which have but attained the degree of skill which we picture in our minds when the "Iron Age" is mentioned. They are making iron in a most primitive fashion, and their methods may be the identical ones used thousands of years ago by the Assyrians. Their metallurgical skill is by no means slight, for they know how to smelt ores in a little cupola blown by a hand bellows, and to employ the right fluxes to obtain a product of remarkably good analysis. They use charcoal as fuel and the chunks of metal which they obtain by first smelting are sold to smiths who refine them still further by a sort of puddling process, and a tool made by this means gave, according to Bellamy and Harbord, the following excellent analysis: Carbon, 1.02; silicon, .026; sulphur, .006; phosphorus, .012; manganese, trace.

During the time of the Norman Conquest and the Tudors, the manufacture of iron in Great Britain was an insignificant industry, and the chief supplies were imported from Germany, and from Germany came the invention which gave a great impulse to the iron and steel business, viz., the invention of the blast furnace. Prior to this invention iron was produced direct from ore in a crude form of hearth, the product being wrought iron or steel, which was obtained in a solid or pasty condition, far from homogeneous in composition, and when large or intricate forms were desired they were made from these crude materials by laborious welding and forging methods. With the invention of larger and improved blast furnaces by the Germans it was found that practically a new metal, fused cast iron, was at the disposal of the early metallurgist. Cast iron was made in Sussex as early as 1350, and the art of iron founding gradually grew and flourished in England and on the continent, until in 1543 cast-iron cannon were made in England, and in 1595 these were made as heavy as three tons each. But cast iron was not only used for foundry purposes, for it was argued that if by one application of the purifying influence of fire, the crude metal had been prepared from the ores, the second application of the same agency might convert it into a malleable product, and wrought iron was subsequently produced in small fineries, and from that day to this the blast furnace has been the first step in the manufacture of iron and steel. Much of this early wrought iron was delightfully low in sulphur and some other impurities, but at that time no means were known of reducing the phosphorus, and the amount of this element present in the product was due to the chance selection of the ore. There were no chemists in those days to say whether the iron contained phosphorus or not, and practical experience with the product in use was the only way of determining the merits of ores from various sources. It was soon discovered that wrought iron by long heating in contact with carbon absorbed some of that element and was thus converted into "cemented" or "blister steel." Blister steel when piled, welded, and forged becomes "shear steel," and if shear steel is piled, welded, and forged the product is known as "double shear." By this piling and welding operation, the carbon which is highest in the outer portions of the cemented bar becomes more uniformly distributed throughout the mass of steel. In 1781, Bergman, of Upsala, pointed out that it was carbon which determines the difference between wrought iron, steel, and cast iron.

The early steel works were all located in the vicinity of great forests, for charcoal was the only fuel used. The works were also located near running streams, and water wheels were used to provide power for the blast, and for the first power hammers. There are many such still in use in Sheffield. In Queen Elizabeth's time the iron trade had become so great that the wholesale destruction of forests was stopped, and the position and number of iron works was limited by law. As the result of this legislation the iron trade languished until Dud Dudley, in 1620 or a little earlier, successfully used coal in the blast furnace. In his day 20 tons a week was a large output for a blast furnace, while to-day the output of one of the blast furnaces at Homestead is nearly 5,000 tons per week. In primitive processes, the workers took advantage of natural draft and located their furnace on a windy hillside. Later, crude bellows were made from hides and still later a blowing arrangement operated by flowing water was invented. Not much real progress could be expected from such crude devices, and one of the first applications of the steam engine of Watt was running a blowing engine at the Carron Iron Works in 1760. It was not until 1730 that it occurred to Abraham Darby and his son to treat pit coal just as his charcoal burners treated wood. His idea, needless to say, was a good one, and coke was produced, which in turn was soon successfully used in the blast furnaces, and is at the present time the principal fuel used in blast furnace practice, although a few charcoal blast furnaces remain in America and are quite common in Sweden. The next great

Digitized by Google

advance in the metallurgy of iron was that of Robert Huntsman, of Sheffield, who first produced crucible steel in the year 1740. As Dr. Percy says, referring to Huntsman: "Formerly, so far as I am aware, steel was never melted and cast after its production; indeed by the founding and casting of steel after its production its heterogeneousness is remedied, and ingots of the metal can be produced perfectly homogeneous throughout, and for the practical solution of this problem we are indebted to Robert Huntsman, of Sheffield."

Huntsman was by trade a clockmaker, and no doubt had his troubles in attempting to make springs from the crude steel which was available in his time. It was to overcome this difficulty that he began experiments with a view to melting the cemented, or blister bar, of his day, to obtain a homogeneous product. A grandfather's clock, the pendulum rod and spring of which are supposed to have been made from the first cast steel produced by Huntsman, is still shown in Sheffield. Huntsman's chief difficulty in his investigations was to find the right kind of clay for making crucibles which would stand the intense heat of steel melting. His first crucibles were only 10 inches high, and held about 20 pounds of steel. Steel made by this process was of course expensive, and could only be used for edge tools, dies, and drills, for which a great degree of hardness and fine polish was desired. The original business started by Robert Huntsman is still conducted by his lineal descendants of the fifth generation at the present time. See STEEL — MANUFACTURE OF CRUCIBLE.

The next great inventions which made for progress in the iron industry were those of Henry Cort (b. 1740; d. 1800), who first made use of grooved rolls in 1784, and in 1785 produced the dry puddling process. The invention of puddling was without doubt, the foundation of Great Britain's commercial greatness during the century that followed. Prior to this time cast iron had been decarbonized in small hearths, very wasteful of fuel and labor, in which only 100 pounds could be treated at a time. Cort invented the reverberatory type of furnace, in which the metal was not in contact with the fuel, but was heated by the flame, which was caused to reverberate, or beat down from the roof of the furnace. This process permitted the use of coal instead of charcoal, and allowed the use of 250 to 500 pound charges. The story of Cort's life is a very sad one, for through a dishonest partner, who died suddenly, his patents were seized to satisfy this partner's liabilities, and Cort died in poverty in 1800. Prominent treasury officials were implicated in this unjust treatment of Cort. Quite recently Americans have erected a bronze tablet to his memory in the little church in Hampstead, in the churchyard of which his grave was located with difficulty.

The invention of the hot blast by J. B. Neilson, of Glasgow, in 1828, afforded the next great advance in the metallurgy of iron. In six months the fuel consumption per ton of product was reduced from somewhat over eight tons to a little over five tons, the blast being heated to 300 degrees F. A few years later the blast was heated to 600 degrees F. and the fuel consumption dropped from 5 1-6 to 2 1-4. At the same time there was a great increase in output as well as decrease in fuel consumption, and the production of pig iron in Scotland increased fivefold between 1830 and 1840, while the use of the hot blast became a general practice during that period. As was the case with Cort, so Neilson reaped almost no reward for his invention, although the wealth it conferred upon iron manufacturers could hardly be reckoned. The same was true of Heath, who in 1840 patented the use of manganese in steel. This conferred an incalculable benefit upon the manufacturers, but Heath died unrewarded after 15 years of litigation.

It was not until 20 years after the discovery of the value of the hot blast that Sir William Siemens introduced the system of regenerative gas firing,— a system in which the waste products of combustion are employed to heat the incoming gas and air of a gas furnace or the blast of a blast furnace. The application of this principle of regenerative heating in the Cowper and Whitwell stoves effected a still further great saving in fuel in the blast furnace, and at the same time increased the yield.

During more than one-half of the last century wrought and cast iron were the only materials available for structural and machine construction, boilers, engines, etc. Crucible steel owing to its high cost could not be used for any of these purposes. Such was the situation when Henry Bessemer gave to the world his wonderful invention. This was the real beginning of the modern age of steel in which we live. Prior to Bessemer's invention there is every reason to believe that William Kelly, an American, was working upon what may be called the "pneumatic process." According to a recent magazine writer, Kelly was experimenting with this process fully 10 years before the date of Bessemer's invention and had built seven stationary converters prior to 1856. His claim of priority of invention was allowed by the United States Patent Office. Nevertheless the process is universally known to-day as the Bessemer process, and indeed there can be little doubt but that Bessemer made an independent discovery of the pneumatic process. Robert Hunt and James M. Swank both agree that for priority of invention William Kelly deserves all praise. See STEEL — BESSEMER PROCESS.

Although the first iron furnace in America was built in 1619, in Virginia, and the first blast furnace with forced blast dates from 1714, nevertheless the iron and steel business did not assume a large magnitude in the United States until the building of the Edgar Thompson furnaces in Pittsburgh, the first of which was blown in in 1879. In these furnaces American skill showed the world how to triple the weekly output and to cut the fuel cost in two. That is, while the best English and Scotch furnaces in 1880 produced from 400 to 800 tons of pig iron per week, and required two tons of coke for one ton of pig, the Edgar Thompson furnaces between 1880 and 1885 produced from 2,000 to 2,500 tons per week, and used only one ton of coke to one ton of pig. The coke in some cases fell as low as 1882 pounds per ton of output. The ore used contained about 62 per cent of iron and the volume of air reached 25,000 cubic feet per minute, at a temperature of 1,000 to 1,100 degrees F.

Digitized by Google

While we thus see that the modern steel industry is of such recent date, yet the invention of the processes now used mainly, viz., the Bessemer (1856) and Open Hearth (1861), for making steel, were relatively of long standing, and the gradual improvements in the processes themselves, their mechanical details and costs, and the gradual education of the large users of metals to employ steel in place of wrought iron and cast iron, gradually led up to the enormous demands of the last 20 years, to which the American manufacturers have responded so energetically.

Henry Bessemer was of a distinctly inventive turn of mind and had many useful inventions to his credit before he turned his attention to steelmaking. He gave considerable attention to the manufacture of projectiles during the Crimean war. The cast iron cannon of this time were seen to be unsuitable for Bessemer's powerful projectiles and he, therefore, set about producing not only the projectiles, but a better material for making large guns. After many trials and discouragements he succeeded in producing steel from cast iron by blowing air through it to oxidize the impurities. His first experiments were performed in a crucible, and this being successful his next idea was to use several crucibles fed by a common air pipe. Later he adopted a large stationary converter about three feet in diameter and seven feet high and used 700 pound charges. The results were most astonishing, for Bessemer found that by the simple method of blowing air into fluid cast iron that the highest temperature then known in the arts was produced. The first formal announcement of his invention was made at the B. A. A. S. in 1856, the title of his paper being 'The Manufacture of Malleable Iron and Steel Without Fuel.' Great excitement followed the reading of this paper and the process was tried in many parts of England, but in many cases the results were anything but satisfactory. The steel produced was red short and cold short. The cause of the trouble was soon found to lie in the use of very impure pig irons running high in sulphur and phosphorus. The first converters were lined with acid or silicious materials, and little or no sulphur or phosphorus was eliminated. As long ago as 1856 Dr. Collyer writing of the effects of phosphorus and sulphur said: "The former I consider most pernicious of all. I would suggest, with due deference, that a stream of finely pulverized anhydrate of lime be forced at a given time with the compressed air into the incandescent mass of iron. The lime having a great affinity for silica and phosphorus would form a silicate and phosphate of lime and be thrown off with the slag. By this contrivance I cannot conceive but that the phosphorus would be entirely got rid of." Here we see the "basic Bessemer" process clearly anticipated many years before it was actually successfully worked out and adopted (1871). The irregularity mentioned above was overcome by the use of selected pig irons, low in sulphur and phosphorus, and by the important discovery of Robert Mushet, viz., the addition of manganese to the metal in the ladle after the blow. The steel in the converter after the blow is dead soft, being nearly carbonless, and contains a good deal of dissolved oxide of iron, beside rather high sulphur and phosphorus. The addition of speigeleisen or ferromanganese corrects all of these troubles. It adds a certain amount of carbon to the steel, thereby increasing its strength and hardness; it deoxidizes the overblown metal and the residual manganese combines chemically with phosphorus and sulphur, some of the sulphide and phosphide being eliminated in the slag, and the rest being rendered relatively harmless by reason of its combining directly with the managanese. After these chemical difficulties with the process had been overcome, Bessemer and others turned their attention to the mechanical side of the question and produced the converter mounted on an axis, so that the vessel could be rotated or tipped down and the air-inlets or tuyeres could be thus brought either above or below the surface of the metal in the converter. This improvement rendered the charging or discharging of the metal much easier. Bessemer was more fortunate than all the other inventors previously mentioned in that he made a vast fortune out of his invention. As a matter of fact his invention was so complete in every way that the process stands to-day exactly as he originated it, excepting for minor details. Over half of all the steel now produced is made in the Bessemer converters.

What the invention of Bessemer steel meant to the world will be seen from a few illustrations.

Steel boiler plates were first used in 1860, and because of their much greater strength, permitted of steam pressure up to 80 pounds being used. This was a great advance in boilermaking. Three years later locomotive boilers were made of steel. But the greatest applications by far for steel were for steel rails and steel ships. The first steel rails were made in the year Bessemer steel was first described to the public. They lasted six years in a place where iron rails had to be replaced every three months. From that day to this the great bulk of steel rails has been made by the Bessemer process. In 1863 two small barges were built of steel, and a year later a steel vessel of 1,250 tons was built.

Basic Bessemer.— Many investigators tried to solve the problem of removing phosphorus in the Bessemer blow, but it was not until the early 70's that Mr. Sidney Thomas came to the conclusion that its non-removal was due to the presence of a strongly acid slag, and obviously a basic slag could not be maintained in an acid lined vessel. After many failures Thomas and his cousin, Mr. Gilchrist, discovered that a lining of lime or dolomite could be made for the converter, using silicate of soda or clay as a binding material, and that additions of lime during the blow facilitated the removal of phosphorus and that an "after-blow" was necessary.

Open Hearth.— The next great advance in the metallurgy of steel was the development of the open-hearth process. (See Steel — Open-Hearth Process.) The prior discovery which led up to the open hearth process was the invention of the regenerative furnace by Sir W. Siemens. William Siemens, a German by birth, had both a technical school and university education. His first visit to England was in 1843 for the purpose of introducing a process of electroplating, by means of which silver was

Digitized by Google

deposited with a bright, smooth surface, rather than in the form of a crystalline deposit. The following year, 1844, he returned again to England and resided during the 40 more years of his useful life.

Siemens, profoundly impressed by the theory of the conservation of energy and with Joule's determination of the mechanical equivalent of heat, was ultimately led to the great discovery of the regenerative gas furnace. Then Siemens invented his gas producer, and with economical gas fuel the regenerative gas furnace was a great success. The first furnace on a commercial scale was used for glass melting in 1861, and a little later it was used for zinc distillation, heating and puddling furnaces, and for melting crucible steel. In this latter application it is used exclusively in America, while in England coke fires are still used for melting crucible steel. These are very wasteful of fuel, and possess not one single advantage over the Siemens producer and regenerative gas crucible melting furnace.

Siemens was not very successful in applying his invention to steel melting on the hearth of the furnace itself, and it was several years before any degree of success was attained in England, but meanwhile Messrs. P. and E. Martin, in France, taking Siemens' own drawings, erected a furnace in France and overcame the obstacles that had almost proven too much for Siemens.

Thus originated the Siemens-Martin process, as it is universally known abroad; while in America it is usually merely designated as the open-hearth process.

Martin produced his steel from wrought iron scrap dissolved in cast iron on the hearth of Siemens' furnace, with the necessary recarbonization at the end of the process and the addition of manganese. This method is known as the "pig and scrap" method. Siemens meantime was working on the method now known as the "pig and ore" method, in which pig-iron is decarbonized by the addition of ore, while scrap may or may not be used. It was not until 1868 that the open-hearth process became an assured success.

As with the case of the Bessemer process, so with the Siemens-Martin, the acid process was the first to be employed. In fact Acid Bessemer and Acid Open Hearth steel both antedate the Basic Bessemer. Thomas and Gilchrist, who perfected the Basic Bessemer process, also realized that the essential change necessary to dephosphorize was to substitute a basic lined furnace for the acid lining which had been previously used, and the maintenance of a basic slag during the operation by the use of lime.

Thomas announced the success of his experiments in 1878 before the Iron and Steel Institute, and although he announced that he had succeeded in removing from 20 to 99.9 per cent of the phosphorus from iron in the converter, and thus rendered available for steelmaking mountains of ore the world over, which without dephosphorization were useless, his announcement attracted little attention, but before many years England was besieged with German, French, American, and other metallurgists, anxious to learn about the epoch-making discovery,— the basic steel process. Germany profited particularly because of the large quantities of phosphoric ores which thus became a valuable asset.

In favor of the Bessemer process we may say that when steel of from .06 to .10 per cent phosphorus is wanted it is a cheaper process than Open Hearth, but low phosphorus Bessemer requires a very careful selection of raw materials. Phosphorus and sulphur must be lower in the raw materials than is desired in the steel. A disadvantage of the Bessemer process is that the steel cannot be tested during the operation. Bessemer plants are suitable where tremendous tonnages of a rather cheap product are required. The Open Hearth process gives a good outlet for steel scrap, billet ends, old rails, etc. The product is more reliable than Bessemer, and the low phosphorus Open Hearth steels are much cheaper than low phosphorus Bessemer. The process allows more latitude in the selection of raw materials. Low or high sulphur pig can be used and both phosphorus and sulphur can be reduced. The steel can be tested chemically and physically during the operation, and whereas in Bessemer it is customary to continue the blow until all the carbon of the pig is oxidized, in the Open Hearth process the decarbonization can be checked when it has gone far enough, or when the carbon desired in the product is reached.

As regards the quality of steels made by the various methods, it is undoubtedly true that even when the analyses are almost identical that Crucible Steel takes first place. Next in order comes Open Hearth, and last place falls to Bessemer. As regards excellence of analysis, they usually stand in the same order, Crucible being finest, Open Hearth next, and Bessemer last. Acid Open Hearth, if the proper materials are used, *i. e.*, if virtually a crucible mixture is melted in an acid Open Hearth furnace, will be a most excellent material, but as actually made, acid Open Hearth is usually very high in sulphur and phosphorus and much of it resembles a Bessemer analysis. In general then Basic Open Hearth takes next rank to Crucible because of its low phosphorus and sulphur contents. In general, of two steels of identical analysis, acid and basic Open Hearth, the former will show much the higher tensile strength. Campbell has even constructed a formula for calculating tensile strength from the analysis, and in his formula it is assumed that each 1/100 per cent of carbon increases the tensile strength by 1,000 pounds in acid steel and only 770 pounds in basic. Each 1/100 per cent phosphorus exerts the same effect in either process and raises the tensile 1,000 pounds. 1/100 per cent manganese in low carbon acid steel raises the tensile 80 pounds and 130 pounds in basic, but the condition is reversed when the carbon is high and then the manganese raises the tensile by 400 pounds per 1/100 per cent in acid and only 250 pounds in basic. The effect of sulphur is very small.

As regards the tonnage production of steel, we find that the most remarkable increase is in Open Hearth steel. In 1905 the increase in production of Open Hearth steel over 1904 was 52 per cent, and the total reached the impressive figure of nearly 9,000,000 tons, or seven times the production of 10 years ago. The total

Digitized by Google

production of Open Hearth and Bessemer in 1896 was 5,250,000 tons, while in 1905 it reached 19,912,751 tons. In 1896, 25 per cent was Open Hearth and 75 per cent Bessemer, while last year 45 per cent was Open Hearth and 55 per cent Bessemer. We may soon expect to see Open Hearth production pass that of Bessemer. One must not imagine from these figures that the production of Bessemer is declining; the opposite is true, and last year was the greatest year on record for Bessemer steel. The facts are merely that Open Hearth is increasing much more rapidly than Bessemer,— but both are increasing. The basic Open Hearth process is responsible for these remarkable gains. Bessemer steel still holds its own for rails, although Open Hearth steel is making some gains in this direction, and is more largely used than Bessemer for other structural purposes.

Of the Bessemer steel made in the United States every bit is acid. Of the Open Hearth steel only one-eighth is acid and seven-eighths basic. Pennsylvania produces 75 per cent of this vast tonnage. Acid steel is largely used for steel castings, and although of the total quantity of Open Hearth made, only one-eighth is acid, yet of the steel castings produced last year fully 60 per cent were of acid steel. The production of steel castings is 1905 increased nearly 75 per cent over the production of 1904.

Electrical processes constitute the latest phase of the steel industry, and are yet in their infancy. See STEEL — ELECTRICAL PROCESSES OF MANUFACTURE

Bibliography.— Swank, 'Iron in All Ages' (Phila. 1884); Jeans, 'History of Iron'; Turner, 'Metallurgy of Iron' (London 1904); Brough, 'The Early Use of Iron' ('Iron and Steel Magazine' XI, p. 417, 1906); Percy, 'Metallurgy of Iron and Steel'; The volumes of the 'Journal of the Iron and Steel Institute'; Casson, 'The Romance of Steel and Iron in America' ('Munsey's Magazine,' XXXV, 1906); Harbord and Hall, 'Metallurgy of Steel' (London 1904); 'Guide to the British Museum' (1890); Scrivenor, 'History of the Iron Trade'; Hadfield, 'Robert Huntsman' ('Trans. American Institute of Mining Engineers, 1894').

JOHN A. MATHEWS,
Assistant Manager, Crucible Steel Company of America, Sanderson Brothers Works.

Steel, the Preservation of Structural. *Introduction.*— The treatment necessary to secure the preservation of the steel used in buildings, bridges, and other engineering structures at the present time, receives less consideration from architects and engineers than its importance warrants. Unfortunately, the preparation of the surface of the metal to put it into a fit condition to receive a preservative coating, and the proper application of such coating, require more time, with our present knowledge, than buyers and builders are willing to allow for them, and more expense than most consumers deem it necessary to undertake. The durability of a steel structure will depend upon the quality of the metal, upon its mass, and upon the measures taken to prevent its deterioration; and its strength, measured either by the stress it will bear or by its resistance to corrosion, is only the strength of its weakest member. Some years ago the surface inspection of steel was one of the most important functions of the inspector. To-day it is one of the least of his duties, and yet flaws, flash, rust, grease and dirt in the surface of the steel are things that may destroy the work of the painters. The enormous increase of late in its use in building and engineering construction demands increasing and vigilant attention to its maintenance and present condition, wherever it has been placed, as either from corrosion, fatigue, vibration, or general deterioration, the metal may be so impaired as to be unfit to do that which it was designed.

Rust.— Rust on iron or steel is formed by the action of a solution of oxygen in water. It is a loose, porous mass, containing about 20 per cent. of combined water, with varying amounts of hygroscopic moisture, and it permits the passage of water and gases through itself to the metal underneath. By keeping the agencies of corrosion always in contact with the surface of the metal not yet affected, this characteristic of rust to absorb and to persistently retain moisture makes possible the progressive corrosion which goes on beneath it, and furnishes a reason for the more or less complete corrosion of rivets and screws frequently noted in steel structures.

Rust has a tendency to grow and spread out from a centre. «Each such centre is a spot at which water has been deposited in the form of drops, or, if the metal has been completely covered with water, it may be the spot from which the water has last evaporated, and therefore where the liquid drop remained the longest time.» «Sweat,» the water of condensation, is always present on a surface of steel or iron, when its temperature is lower than that of the surrounding atmosphere. A wash of rain is less apt to be injurious to steel than the deposition of water in drops or in a thin film over the surface (dew).

Steel neither rusts in dry air nor in water free from air and carbon-dioxide. The best protection will therefore be obtained from the most impervious coating. It may be noted that the general cause for the failure of preservative coatings to protect steel from rust is that they are permeable to moist air and carbon-dioxide, which are the most common agencies for the corrosion of the metal itself.

Some agencies for rapid corrosion: (1) Smoke and heated vapors issuing from locomotives; (2) «Collection of soot, dust, or anything that will retain moisture in sheltered places;» (3) alternate exposure to air and water; (4) exposure to acid or alkaline gases, vapors, or liquids; (5) considerable and varying heat and cold; (6) «Constant or alternately occurring heavy rains with drying winds, hot sun, frost or snow; (7) heating apparatus in buildings causing damp places in walls; (8) brackish soil and sewage; (9) salt-water drippings from refrigerator cars; (10) damp, vitiated air in tunnels, subways, covered and confined places of all kinds; (11) electrolytic action; (12) decaying animal or vegetable matter.

Cleaning.— Any steel upon which it is desired to apply a preservative coating should have its surface in such condition that the coating will adhere well to it, and also so free from rust that progressive oxidation will not take place underneath it. A coating of hydrofuge

Digitized by Google

material cannot from its very nature stick well to a surface that is damp, rusty, or greasy, neither does it serve any good purpose when applied to detachable scale. Engineers differ as to the best method of securing a receptive surface for painting, and some seem to give the subject little thought; however, much of the expense of repainting in the future would be saved if all scale, rust, grease, and dirt were removed from the surface of the metal at the shops before applying the first coating of paint to new works. An oil or a varnish paint will be attracted to and held well by a steel surface when it is clean, warm and dry; such a surface can be had if purchasers are willing to pay for it, but they must be convinced of its necessity and ultimate economy before undertaking to do so.

"All steel as it leaves the rolls or hammer has a tough, thick, or thin coat of loose or partly loose scale that adheres for the time being, but on short exposure to the air with a few changes in temperature, due to mill or storehouse conditions, releases its tension and is ready to fall off whenever handled, as in course of loading and transportation."

Steel that is subjected to machine operations in assembling shops or places where bridges are fabricated is more or less covered with machine grease.

No surface of steel should be coated unless it shows the grayish-white natural color of the metal and is fairly dry and fairly warm.

The common method of cleaning steel is to remove grease with petroleum naphtha (benzine), rust and dirt with wire brushes, and detachable mill scale with hammer and chisel. The sandblast is probably the most efficient and economical method of preparing structural steel to receive a preservative coating. It leaves the metal not only clean but fairly dry — an important and essential condition if a receptive surface is to be secured. The painting of the metal should follow immediately after the cleaning is done, as cleaned metal will corrode under ordinary atmospheric conditions much more rapidily than uncleaned metal.

Portable sand-blast machines and portable air compressors are now available. The outfit besides these includes a sand drying apparatus, hose, nozzles, etc. The sand used should be clean and hard; it its particles are round, it will leave a smoother surface than if they are sharp. Where the surface is very rusty and the metal pitted, a coarser sand is needed than for the removal of ordinary weather rust. It is argued that aside from the scientific value of sand-blasting, there is a very serious question of its effect upon the eyes and lungs of the operator; it is further argued that the sand-blast should not be used to clean new metal because it will remove the sub-oxide, black oxide, or mill scale, which in itself, like paint, is a protection against rust formation so long as it remains.

"When pickling is used, the pickling liquid is almost always dilute sulphuric acid (oil of vitriol), and containing from 20 to 25 per cent. of acid. It is preferably used warm, and the articles are left in it till the surface is perfectly clean and free from rust and scale. The time will vary according to the condition of the metal, from a few minutes up to an hour or so. A much weaker acid than that mentioned is sometimes used, or the acid is used cold, but in these cases the article must be cleaned with alkali before it is put into the pickling vat. After the pickling, the acid must be removed from the surface as rapidily as possible, and this is best done by means of a jet of water discharged at high pressure, mere rinsing not being efficient for the purpose.

"Hydrochloric acid (muriatic acid) is not so satisfactory as sulphuric acid. If the metal be allowed to dry in the air the surface is likely to rust. To avoid this it should be put into a boiling bath of milk of lime, and left in this until it has acquired the temperature of the bath. It is then taken out, dried in an oven, and when dry this lime is brushed off. The surface left by pickling is susceptible to rust, and, therefore, a protecting layer of some kind must be applied at once."

With present facilities at steel plants and assembling shops, neither space nor time is available for cleaning steel, either by pickling or with the sand-blast, so the common practice is to substitute quicker and less reliable methods of preparing the surface to receive paint.

Paint.— At the present time oil paints are generally used for coating structural steel. While varnish paints may be more efficient for metal not exposed to the action of rainfall and sunshine, or under some special conditions, yet experience indicates that oil paints are the proper coatings for preserving and protecting steel used in building and engineering construction.

Oil paints are pigment mixed and mulled with oil, and especially designed to preserve, to protect, and to better the appearance of surfaces to which they are applied. In oil paints of value, the end aimed at is a close union of solids (pigment) and liquids (binder), *i. e.* inorganic or solid matter in a finely divided state is taken and mixed with organic or liquid matter, and then these are linked together either mechanically or chemically. Ordinary mechanical mixtures in which the solids and liquids have little or no affinity for each other, or in which the powders are feebly suspended in the liquid, scarcely deserve the name of paint. The essentials of a preservative and protective covering for structural steel may be stated as follows:

1. *Mechanical Properties.*— That it must work properly, that is, offer but a slight resistance to the stroke of the brush, and be of such fluid nature as to flow together after the brush so that the resulting covering or skin is one of even thickness.

2. *Chemical Properties.*— That it must not only dry, or oxidize, fast enough, but dry simultaneously throughout; not harden on the surface and remain soft underneath, or in painters' parlance, "skin over."

3. *Physical Properties.*— That it must be of such nature that when it has formed a skin upon the surface of the metal it can take other coats of paint without softening under them (hardness); that it must wear well, provided a sufficient number of coatings of it is applied (indestructibility); that it must exclude moisture from the metal covered with it, *i. e.*, prevent its corrosion (impenetrability).

How best to secure these essential features

Digitized by Google

is a problem which has puzzled the heads and vexed the hearts of painters, chemists, and engineers for years, and it will probably continue to do so for years to come or until some means are devised under which it will be possible to determine quickly what coatings satisfy the requirements of service and use. The author's faith is, at the present writing, established in oil paints, because years of study, observation, and experience in manufacturing all forms of paint, have demonstrated their superiority for steel, if well made, to coatings of any other kind.

From «sense impressions,» gained by study of the phenomena pertaining to paint, both wet and dry, his present conception is that pigment is the objective element and liquid the subjective element in it. The pigment is the male principle; liquid, the female. In order to give expression to his thoughts upon this question, it appears necessary to consider the nature of linseed oil. Many books have been written upon this subject and there is yet much to learn. Linseed oil, even if of good quality, is not sacred, but, after centuries of use, it still holds its own as the best oil for painters' use where durability is the main consideration.

Linseed oil in drying changes from a liquid, first into a sort of jelly and then to a solid, rubber-like substance, which not only holds itself together, but also clings to any dry substance upon which it is formed. Linseed oil in drying takes something from the air, namely, oxygen, and gives off something to the air, namely, carbon-dioxide and water. Mulder beautifully describes the process and calls it «the breathing of the drying oils.» In his book, 'Die Chemie der Austrocknenden Oele,' he named the solid, rubber-like substance into which a layer of linseed oil finally hardens, «linoxyn.» Linoxyn is a solid, not a liquid. It is insoluble in many liquids and is far less soluble in any solvent than linseed oil. Specimens of it kept for months in dilute acid and weak alkaline solutions, also in spirits of turpentine, petroleum naphtha, linseed oil, alcohol, chloroform, acetone, carbon-bisulphide, and water, show but slight decomposition or solution, thus indicating its power of resistance to atmospheric influences.

A layer of dried linseed oil (linoxyn) is not waterproof, although no compound is probably chemically more resistant to atmospheric influences (not mechanical wear). For example, it is claimed that a gallon of oil spread upon 100 square feet of surface will outwear a gallon of any paint spread upon the same area of a similar surface; but it may be noted that it will require about three times as many coatings of the oil to use up the gallon as it will of the paint to use it up. From this it is concluded that a layer of paint is about three times as thick as a layer of the oil. Experiments of this kind demonstrate that one of the functions of pigment is to increase the thickness of the layer of dried paint, and that this increase of thickness is in direct proportion to the volume or fineness of the pigment. They also determine that, given the same volume of oil and the same weight of pigment, the greater the volume of the latter, *i. e.* the finer the division of its particles, the more slowly will the paint dry and the longer will it wear.

Pigments fit for use in structural oil paints are of two general classes, viz., those that react more or less with the oil, notably the carbonates and all of the lead pigments, and those that have no chemical action on the oil or binder, *i, e.*, that are called inert, such as the carbons, silicates, probably ferric oxides, etc. The former class produce the quicker drying and the less durable paints; the latter, the slower drying and the more durable coatings; *e. g.*, a paint made from white lead and linseed oil when properly applied to a sound surface cannot be expected to protect it, under fair conditions, more than five or six years, while a paint made from «Venetian» red and the same oil, applied to a like surface under similar conditions, will protect it easily twice as long. The observer will note this if he will recall his observations of the durability of paint made from ordinary mineral colors on barns or freight cars, as compared with the more delicate tints used on houses and more elaborate structures. Another feature of interest pertaining to inert pigments is, that where the same liquids are used with them for the paint for each coating applied, the observer finds that the dried paint seldom cracks, peels, or blisters, and if it does the inference should be that his paint contained an inadequate amount of pigment. Given a perfect binder, the paint problem would be simple, for then the only function of pigment would be to color and obscure the surface. Until, however, a binder is obtained that will dry fast enough, that when dry is impervious to moisture and gases, and that will not wear out, pigment will be necessary to shield and to protect the dried oil from the agencies that destroy it, the chief of which are rainwater and sunshine.

A pigment that will not hold the oil produces a fugitive paint. Any pigment that will take and retain oil or binding material, and that is not changed by the agencies that destroy dried oil, or the binder, will make a durable paint for structural steel provided it is fairly treated and properly applied to a surface in fit condition to receive paint.

The decay of paint is due to chemical change, and nearly all chemical reactions are accelerated by water and heat. It is, therefore, necessary in designing protective coverings that materials be used which are repellent of moisture and as slightly affected by heat as possible.

To understand the pigment question one needs some knowledge of forces which are insensible at sensible distances, viz., molecular forces, such as surface attraction, chemical affinity, etc. All phenomena taking place in paint are due either to physical action (heat, light, electricity), or to chemical action, that is, the attractive or decomposing influence of one substance upon another.

Andes in his work on 'Anti-Corrosive Paints,' in discussing the number of coats of oil paint that must be applied to iron in order to secure efficient protection against rusting, says that in establishing a standard, preference must undoubtedly be accorded to paints requiring a large proportion of oil to make them work properly. He says: «It may be laid down as a normal standard that, presupposing the use of good paint, one bottoming coat and three subsequent coatings, laid on at suitable inter-

Digitized by Google

vals, will be required to produce a layer of sufficient thickness on iron to keep moisture away from the metal and to protect the latter from rust for a certain time." The first or prime coat upon a surface of steel, in a fit condition to receive paint, is of the greatest importance, especially as to its drying, hardening, adhesiveness and impermeability to water.

The author works upon the theory that the paint used for priming naked steel should be of a preservative nature, *i. e.* of such a nature that it will absolutely exclude air and water from the metal; and that the finishing or top coats should be of a protective nature, *i. e.* of such nature that they will protect the primer or bottoming paint from the action of rainfall, sunshine or any special external condition. As the first or prime coat must form a receptive foundation that will be able to hold all subsequent or protective coatings both on and up, it should be largely formed of basic materials, so composed as to secure on the surface of the metal a firm and unyielding coating of an elastic, durable, cohesive and adhesive cement; it is probably necessary that this cement be made from a pigment that secures chemical action between itself and the liquid with which it is mixed, for it is only through the use of such a pigment that a skin or covering can be secured upon unheated metal that will be impervious to air and water.

Theoretically, red lead in competent hands is the best pigment to use with linseed oil for making a primer for naked steel; it forms a rapid-drying, firm, unyielding, impervious, non-corrosive, and receptive covering upon the metal, its only defect being that it will undergo chemical change when exposed to ordinary atmospheric conditions; therefore, the necessity at all times of protecting the red lead with outer coatings of paint made from linseed oil and pigments that have no chemical action upon it, such as the carbons, ferric oxides, etc., that is, paint made from inert pigments. Red lead paint forms the best foundation. No one builds a stone house upon a wood foundation, but may build a wooden house upon a stone foundation.

Unfortunately or otherwise, the cost of red lead, its great specific gravity or weight, the great fatigue attendant upon its proper application, the improbability of getting an even coating on the surface, its tendency to fatten or set, the trouble of mixing the dry pigment with the oil, its rapid settling when so mixed, and its poisonous nature, have prevented its adoption where its virtues have been acknowledged. False ideas of economy have too often been responsible for unwise attempts to preserve valuable structures with coverings made of inferior materials, the only logical conclusion, that "the best is not good enough," being entirely lost sight of. Recent investigation has been able to produce a red lead product that overcomes many of these difficulties; *i. e.* red lead paints are now made ready for application that do not settle or become hard and that scarcely offer any more resistance to the stroke of the brush than well-made house paints.

As to the character of the pigments that should be used with linseed oil for making paint for use as top coats over a red lead primer, it is important that the pigments used be both chemically and physically inert, that they be in a finely divided state, and that they have an affinity for linseed oil. Given these features, whether the pigment is lamp black, graphite, oxide of iron, charcoal, silica, mica, aluminum, or what not, is a matter of little importance so far as durability is concerned. Where three or more coats are to be applied and it is not practicable to use more than two kinds of paint, one can use for middle coat mixtures of topping and bottoming coats.

Paint users have no just reason for condemning this, that, or the other pigment or binder, as tested upon any given structure, unless they know, first, the history and characteristics of the material used; second, the kind and condition of the surface to which it was applied; and, third, the method of application. Many pigments, such as some kinds of red lead, iron oxide, carbon, white lead, etc., may give good results, if fairly treated, but if improperly compounded and applied, prove failures. Engineers, architects, etc., should demand paints that do not require great skill, and which do not involve great fatigue, in their proper application.

A perfect paint for structural steel would be one in which the pigment (inorganic) and binder (organic) formed a close union (marriage), so that there could be no separation of them; no precipitation of the pigment. In other words, it would form and secure upon the surface of the metal an even covering of an adhesive, cohesive, elastic, harmless, and durable cement, impervious to and unaffected by either moisture, sunlight, or gas. The desired features of an anti-corrosive metal covering are, that it (1) Should hide the surface; (2) should cement itself together, and also cement itself to either damp or dry metallic surfaces; (3) should expand and contract without breaking its own body; (4) should present a hard, yet tough, outer surface; (5) should be impervious to water, marsh-gas, or other gases; (6) should be unaffected by sunshine, heat, frost, dew or climatic changes; (7) should be unaffected by ordinary mechanical abraison; (8) should wear evenly; (9) should fail by gradual wear, not by disintegration; (10) should leave a good surface for repainting; (11) should not require an unreasonable amount of skill or muscle in application; (12) should be homogeneous; (13) should dry fast enough; (14) should not be readily ignited; (15) should have power to extract moisture or dampness from the metal.

Main causes for deterioration of paint are: (1) Water (dissolution); (2) action of light and heat (chemical and physical change); (3) chemical action between pigment and binder (disintegration); (4) abrasion or mechanical injury (motion); (5) action of deleterious gases (foul air).

A worthy metal coating sometimes fails: (1) Because of improper application (incompetent or careless users); (2) because of insufficient quantity on a given surface; not renewed at right time (perishes quickly); (3) because of an unstable foundation to stick to (dirt, grease, dampness or scale under it); (4) because the under-coating is more elastic than that over it (cracks); (5) because not protected when drying (wet paint sensitive).

Painting.— The coating of structural steel with paint is for the special purpose of pre-

Digitized by Google

venting air and water from getting at it, as a combination of these will destroy steel, and that quickly if carbonic or some other acid be also present. It is not the author's purpose to suggest or discuss methods of applying coverings to structural steel other than to insist that a mechanic, to do good work, must have good tools to work with and fair conditions under which to do the work set before him. Many worthy paints are ruined because flowed on with a broad, thin, flat brush, not much better than a common whitewash brush, instead of being rubbed out and into the surface well with a good, full, round, bristle brush; and then, again, painters are apt, if the pigment used is heavy, or the parts to be covered are difficult of access, to add an excess of thinners to save labor or cost for material. A layer of air exists on all surfaces; hence the importance of rubbing out paint thoroughly, as otherwise bubbles of air may be covered, which, coming through the paint, render the coating porous. It is known that the durability of any oil paint depends largely upon the number of particles of pigment upon a given area of surface, and that the more particles of pigment the better the protection to the binder and to the metal underneath; the evil of thinning too much is, therefore, obvious. As to the spraying of paint upon structural steel by means of an air compresser, it is argued that this method conveys air and moisture to the metal and corrodes it. The adherence of paint will be increased if the metal is moderately heated before it is primed, because if it is warmed by artificial heat, the surface will be dry. «Mill marks,» even though made with inferior paint, generally afford excellent protection to steel because the paint was applied to the metal when it was clean and warm.

When painting is to be done in the field, or under conditions that make it impracticable to warm and dry the metal artifically, it is a good plan to apply paint heated to a temperature of about 150° F., especially when the temperature of the atmosphere is below 55° F. This warming of paint may be attained by placing the pails of paint in vessels of hot water. It is important that one should always note the atmospheric conditions when the work of painting is being done. A temperature of about 70° F. and an atmosphere that is free from moisture favor the right kind of drying. The humidity of the atmosphere is even more important than its temperature. Nothing retards drying more than dampness and darkness.

To aid in the inspection of new work, a shop coating of linseed oil is often specified. This does, in a measure, protect the iron from rust, but a very uneven film of dried oil probably will be secured from this method of treatment. Oil applied to a vertical surface runs off until the layer reaches a certain thickness. Where the current meets with an obstruction it piles up into a thick and uneven coating. These thick parts of the layer may require months to harden into a substance firm enough to be fit to paint over. The results are most disastrous in cold weather when oil thickens and contracts. As painters express it, oil, when applied to cold steel, crawls, wrinkles, and crinkles. If linseed oil is used as a primer on steel, it should be used hot, not warm, then it will penetrate the skin of the metal and one may gain a thin and even film, hard enough to form a surface fit to receive paint.

Many places such as «the under and inner sides of girders, bolt-heads and nuts, rivets, etc., which should be painted with great care to prevent the incursion of water, are often overlooked or neglected. To aid inspectors, a proper check upon the workmanship can be secured by selecting different colors for the several coatings, so that uncoated or defective places may be readily detected.»

A distinguished British painter and author writes: «The less paint that is put on at each operation, consistently with a proper covering of the ground, the better will the ultimate result be.» «Less paint and more painting,» he impresses as a need «to quite 90 per cent. of painter students.» «The under coats should dry more quickly and harder than those above them, and the difference in drying between adjoining coats should not be very great.»

Large numbers of experiments give ocular demonstrations of the fact that a first coating of good red-lead paint covered by a layer of good carbon or ferric oxide paint will prevent corrosion for a much greater period than two coatings of any one kind of paint.

To secure durability with paint, it should always be used fairly thick, and then well rubbed out under the brush into thin and even layers. If not well brushed it will lack firm adherence. From experiments with an ocular micrometer in connection with a microscope, it is found that single coats of dried paint vary in thickness from 1/500 to 1/1000 of an inch, the difference being due either to the manner of application, *i. e.*, whether under light or heavy pressure of the brush, or to the difference in the consistency of the paints tested. Few realize the thinness of coatings of paint or the strains to which its dried films are subjected.

Viaducts, tunnels, crossing bridges, etc., require different treatment from structures exposed chiefly to the action of rain-water and sunshine. Linseed oil, in drying, as already explained, undergoes a metamorphosis; and the result of this process is a solid, linoxyn. A film of this dried linseed oil, or linoxyn, is not quickly formed without dry air and light, but once formed, is much more stable and better able to resist the agencies that destroy paint than a thin layer of undried linseed oil; in other words, wet paint is much more sensitive than dried paint. Therefore, in locations that are ill-ventilated, that get no sunshine, that are damp and filled at times with steam and acid gases, one must have material of a different kind for coating steel. Varnish or resin paints are well adapted to work of this kind, and especially so where a primer coating of red-lead paint, so composed that it will dry rapidly, has been used.

Much has been said and written of late regarding the apparent failure of paints of wide reputation when applied to steel cars. From a limited personal knowledge and from information gained from others who have handled thousands of hopper-bottom gondolas and box cars with steel under frames, the author is led to conclude that some contract shops use less of the paint specified than has been presumed. What they do use is frequently applied in the

Digitized by Google

open under such unfavorable weather conditions, and under conditions of painting contracts at such a low rate per car, as to preclude the possibility of either employing competent workmen to apply the paint or such application of it as to prevent corrosion. Good paint illegitimately thinned with cheap oils or japans is practically rendered of little protective value, and to apply it to steel cars more or less covered with rolling-mill scale, dew, frost, snow, slush, ice, grease, etc., is waste of time, thought, and material. There is no reason why paint applied to steel cars should not wear as well as paint applied to any other steel structures, provided it is used under fair conditions, applied by competent workmen, and enough time for drying is allowed to elapse between coatings. The only way to secure better painting is to employ competent and vigilant inspection of the painter's work.

Factors that Affect Results in Painting.— (1) Location of the structure, *e. g.*, seaboard or inland; (2) kind and condition of the surface; (3) quality of the paint; (4) workmanship of the painter; (5) number of coats applied; (6) time allowed to elapse between coats; (7) atmospheric conditions when painting is done.

Tests.— Paint tests may be of three kinds, namely, chemical, mechanical, and physical tests.

Chemical Tests.— In the selection of solids and liquids for paint-making, it is well to know that they contain no deleterious matter, such as soluble solids or destructive liquids, nor useless substances either to make weight or to make bulk. Chemistry can tell these things, but it cannot tell the quality of the bulk of paint materials used. "Chemistry is physics applied to atoms and molecules." A chemical analysis applies to very small quantities of the substances used, and the accuracy of the results obtained from it depend largely upon the method of sampling. When one considers that about all pigments are allotropic, that no two lots of paint liquids are exactly alike, and that any prepared paint changes more or less, in one way or another, with age, the chemist's test is proved to be of value in so far as it relates to the matter subject to his analysis and determinations, and no further.

The popular idea of a chemist is that of one who can analyze material substances and determine their composition — that is, take them apart; the main study of the progressive paint-maker of to-day is synthetic chemistry — that is, combining separate substances into new forms. Chemistry can tell things that may have been used in making a paint; it can foretell some phenomena that it may develop, but it cannot at all surely predict its "vis viva"— that is, what the stuff will do, and what it will do is the only true measure of its value or worth.

Mechanical Tests.— By this is meant tests made by a skillful painter. No one can determine the working qualities of paint as well as the man whose eye and hand and arm are trained through practice. The importance of the proper application of paint receives less attention than it deserves, *e. g.*, air bubbles may be worked out of paint by means of thorough brushing with good tools, and then again a poor painter may use 50 per cent. more material upon a given surface than a good painter will use, and get poorer results with it. Engineers and architects should demand the employment of competent artisans to do their painting, for results are often more dependent upon the intelligence and good will of the painter than upon the quality of the material used.

Physical Tests.— By this is meant weather tests, or the exposure of the dried paint, on metallic or other surfaces, to the destructive forces of nature, such as sunshine, rain-fall, frost, dew, heat, cold, light, darkness, etc., or to those agencies which are frequently present in atmospheric air, that shorten the life of dried paint, such as acid or alkaline gases and vapors. Comparative tests on limited surfaces — that is, small plates of steel or glass — are often misleading, because a painter cannot guage his work with unfamiliar material, and because his brush probably will not be in condition to give the paint a fair show. In order to make such tests more reliable, they should be repeated a number of times to note if results are concordant; and large sizes of plates should be used, as recommended by the American Society for Testing Materials, say ¼" x 20" x 24" prepared in pairs, "one to be exposed green and the other to be thoroughly dried under favorable conditions previous to exposure."

Actual service tests under normal conditions give the most conclusive data, but so long as it takes years to make them, common sense dictates that consumers should hold fast to materials that universal experience has proven trustworthy until better are found. Accelerated tests under "abnormally severe conditions" have little value unless "the results obtained by the method selected will be in harmony with long time service tests." It is easy to test the water-proofing quality of a dried coating of paint, but such a test determines nothing more than the ability of the paint to exclude water from the surface underneath it. It is easy to test the effect of artificial heat upon dried paint, but this does not determine the power of the paint to withstand sunshine. The author has found no quick test to determine the probable life of paint, under given conditions, but he is led to conclude that one intimately acquainted with the properties of the subject-matter, and with the forces of nature, may reasonably predict its life, if he knows the method of application, the conditions under which it is to be exposed, and the condition of the surface upon which it is to be applied.

Bibliography.— Andes, 'Iron Corrosion' and 'Drying Oils and Boiled Oils'; Bersch, 'Mineral and Lake Pigments'; Campbell, 'Manufacture and Properties of Structural Steel'; Condit, 'Painting and Painters' Materials'; Church, 'The Chemistry of Paints and Painting'; Howe, 'Iron, Steel, and Other Alloys'; Hurst, 'Painters' Colors, Oils, and Varnishes'; Lewkowitsch, 'Chemical Technology and Analysis of Oils, Fats, and Waxes'; Livache and McIntosh, 'Varnishes, Oil Crushing, Etc.'; Metcalf, 'Steel: A Manual for Steel Users'; Mulder, 'Die Chemie der Austrocknenden Oele'; Newman, 'Metallic Structures; Corrosion and Fouling and Their Prevention'; Parry and Coste, 'The Chemistry of Pigments'; Pearce, 'Painting and Decorating'; Riffault, Vergnaud and Toussaint, 'Colors for Painting'; Sabin, 'Technology of Paint and Varnish'; Sexton, 'The Corrosion and protection

Digitized by Google

of Metals'; Spennrath, 'Protective Coverings for Iron'; Terry, 'Pigments, Paint and Painting'; Vibert, 'Science of Painting'; Wood, 'Rustless Coatings'; 'Transactions of the American Society of Civil Engineers' (Vol. L.); 'Proceedings of the American Society for Testing Materials' (Vols. III., IV., and V.).

HOUSTON LOWE,
Author of 'Hints on Painting Structural Steel.

Steel Manufacture. The following list will direct the reader to the articles in this Encyclopedia pertaining to Steel and allied topics: STEEL; IRON AND STEEL, METALLOGRAPHY OF; STEEL — THE BESSEMER PROCESS; STEEL — ELECTRICAL PROCESSES OF MANUFACTURE; STEEL — MANUFACTURE OF CRUCIBLE; STEEL — OPEN HEARTH MANUFACTURE; STEEL — SPECIAL OR ALLOY STEELS; STEEL — THE EVOLUTION OF STEEL MAKING PROCESSES; STEEL — THE PRESERVATION OF STRUCTURAL; BLAST FURNACE PRACTICE; DROP FORGING; FOUNDRY PRACTICE; IRON FOUNDING, CHEMISTRY IN; CAST IRON, MALLEABLE; IRON, MANUFACTURE OF; COKE; FOUNDING; STEEL, TESTING OF; STEEL WIRE AND NAIL MAKING; STEEL INDUSTRY IN THE UNITED STATES; IRON AND STEEL INDUSTRY IN THE UNITED STATES; CUTLERY; HARDWARE TRADE IN THE UNITED STATES; STEEL CAR INDUSTRY; PIPE, MANUFACTURE OF; METALLURGY; ALUMINO-THERMICS; TEMPERING; ENGINEERING AND STRUCTURAL TERMS; FOUNDRY AND FORGE SHOP TERMS; LOCOMOTIVE, DESIGN AND CONSTRUCTION OF THE MODERN; BOILER TERMS; VALVES AND VALVE TERMS; WORKSHOP TERMS; MECHANICAL MOVEMENTS; AIR COMPRESSORS; COAL MINING MACHINERY; CRUSHING AND GRINDING MACHINERY; DIES AND DIE MAKING; ELECTRIC FURNACES; METAL WORKING MACHINERY; FORGE, FORGING AND FORGING MACHINES; MINING AND MILLING MACHINERY; NAILS; ORDNANCE; PNEUMATIC TOOLS; PUMPS AND PUMPING MACHINERY; SAWS AND SAW MAKING; TESTING MACHINES; TOOLS AND TOOL MAKING; VALVES AND HYDRANTS; WHEEL GEARING; WOOD-WORKING MACHINERY, ETC.

Steel Car Industry, The. As a representative industry the building of steel railroad cars is of modern introduction in the United States, but is now recognized as one of the most prominent of our industries. European countries were pioneers in the use of iron cars, and as early as 1861 we find records of cars with iron bodies being built in France, while in India iron was substituted for wood at an early date, as the latter material was particularly susceptible to the attacks of ants and other insects, which condition necessitated the use of iron or steel in the construction of equipment for use on the railroads of that country. In other foreign countries the selection of iron for this purpose was undoubtedly governed largely by the comparative cost of iron and wood, which in many instances favored the use of the former material, and also for the reason that climatic conditions in many of these countries are such that wooden cars rapidly disintegrate. To the American engineer, however, should be given the credit of foreseeing the possibilities of steel in car construction, not solely from a constructive standpoint, but as a scientific solution of the problem of economical transportation. The successful operation of a railway is dependent on the relative cost of transportation, and the use of steel in car construction has made it possible to decrease to the minimum the percentage of dead weight to that of paying load. The progress made in the proper appreciation of the stresses to which the different parts of a car are subjected has resulted in great improvements, providing ample strength for the duties imposed on the several parts, eliminating superfluous material where it may be done without detriment to the car as a whole, thus producing, in steel, cars of minimum weight and maximum strength. This favorable comparison of percentage of dead weight to paying load is much more evident in the higher capacity cars, where the full benefit of the difference in strength between wood and metal may be realized.

The capacity of freight cars in this country has been continually on the increase, and constant efforts are being made to reduce the relative proportion between weight of car and weight of lading. Up to 1876 the average freight car had a carrying capacity of 20,000 pounds, while the ratio of paying load to total weight of car and lading was about 47 per cent. In 1880 the capacity had been increased to 40,000 pounds, and the ratio of paying load to 60 per cent; in 1883 to 50,000 pounds and 65 per cent; in 1889 to 60,000 pounds and 66 per cent; in 1895 to 80,000 pounds and 68 per cent; and in 1903 to 100,000 to 110,000 pounds and 75 to 79 per cent, respectively.

The general introduction of the steel car was not accomplished without serious opposition; first, from those who were directly interested in the manufacture of wooden cars; and second, from those who were skeptical as to the advisability of adopting steel as a vehicle of transportation, exposed to the action of injurious elements which might cause a rapid deterioration of the metal and a consequent reduction in strength. However, up to the present time no serious effects from this cause can be noticed in the cars now in service. If proper attention is given to the method of construction and weight of metal used, and all parts are thoroughly painted at the time of manufacture to protect them from corrosion, and if after the cars are placed in service care is taken to repaint them when necessary, it is fair to presume, judging from the present condition of the earlier steel cars built in this country, that we may reasonably expect an average length of service from the steel car of at least 30 years, or fully twice as long as the service obtained from cars of wood construction.

The steel car industry may be correctly said to date its origin in this country from the year 1896, although the records of the Patent Office show that patents were granted to citizens of this country, as well as of foreign countries, for cars made entirely of steel or other metal, as early as 1854; and it is also true that prior to this time cars of metal, or a combination of metal and wood, had been constructed and put in service in this country; but these early efforts had little in common with the modern steel car, now standard on many of our leading railways. Previous to the year 1897 many cars had been constructed in this country of steel or iron, but were built for special service by the several railroads, mainly for the purpose of facilitating the transportation of heavy materials, where the load was more or less concentrated, such as wire cables, guns, bridge gird-

Digitized by Google

era, etc. In the design of such special equipment no particular attention was given to the consideration of a reduction of the weight of the component parts, with the result that most of these earlier metal cars were excessively heavy and not suitable for general service.

Iron box cars were used as early as 1862, these having been built by the Baltimore & Ohio Railroad, and weighed 18,000 pounds, with a capacity of 30,000 pounds. Later, in 1869, the Lake Shore & Michigan Southern Railroad placed in service flat cars with iron channel sills, and the New York Central & Hudson River Railroad had several metal cars running on its road as early as 1873. In these cars the substitution of iron for wood was more particularly confined to the underframing of the car, the superstructure, if any, being of wood. In connection with these early types of metal underframes mention may also be made of steel underframes for carrying water tanks of locomotives, which were in use as early as 1881.

It was not until 1887, however, that metal underframe cars were placed in service in any considerable numbers, these being built under patents owned by the Southern Iron Car Company, who constructed several thousand steel underframe freight cars, including box cars, hopper bottom gondola cars, flat cars, etc. These underframes were of the iron tubular type, being formed by the assemblement of different sizes of wrought iron pipe, tied together by means of threaded connections, so as to form a light and compact structure. However, in actual service it was found that the connections would rapidly loosen, thus destroying the strength of the whole, and after only a comparatively short time the construction of cars of this type was entirely abandoned. From this time on numerous experimental cars with steel underframing were built, but the unsatisfactory results derived from the tubular underframe undoubtedly retarded the adoption of the modern type of steel underframe car. The Pennsylvania Railroad in 1887 built a number of cars having steel underframes which were designed to carry a concentrated load of 120,000 pounds; and a steel fireproof car was built in 1889 at the shops of the Louisville, New Albany & Chicago Railroad. The Chicago, Burlington & Quincy Railroad, about the year 1890, placed in service a steel car of 60,000 pounds capacity, constructed from designs of the Harvey Steel Car Company.

In 1894 the Carnegie Steel Company ordered from the Fox Solid Pressed Steel Equipment Company, of Joliet, Ill., a number of steel flat cars of 80,000 pounds capacity, to be used in service about its mills for the transportation of heavy billets. These were built entirely from pressed steel shapes, and embodied in their design special features of pressed steel work, being similar in this respect to cars then being built by the Leeds Forge Company of England, both the Fox Solid Pressed Steel Equipment Company and the Leeds Forge Company being controlled by Sampson Fox, who was the originator of pressed steel shapes in car construction. Up to this time, 1894, the possibilities of the use of steel in car construction, it is fair to state, were not fully appreciated by those controlling the design and operation of railroad equipment, and to the Carnegie Steel Company should be given the credit for properly placing before the railroad world the possible advantages to be derived from the use of an all-steel car. The interest displayed by the Carnegie Company was no doubt largely the result of a desire to increase the demand for its product by providing additional avenues for the consumption of steel plates and shapes. The arguments at that time set forth in favor of the use of steel for freight car construction, and all which claims experience has since verified, were, lightness, durability, strength, greater proportion of paying load to total weight of car, reduced cost of maintenance, less liability to damage and greater salvage value.

To further exploit the possibilities of steel in car construction the Carnegie Steel Company, in 1896, had built at the Keystone Bridge Works three all-steel cars, one of these being a steel flat car, and two self-clearing hopper cars, in which the floors are inclined from the ends downward toward the centre, and at the bottom of these inclines doors being provided, which, when opened, permit the load to discharge by gravity. These cars were exhibited at the conventions of the Master Car Builders and Master Mechanics' Associations, held at Saratoga in June 1896, and elicited the interest of car builders and railroad men throughout the country. Rolled plates and shapes, which could be purchased in the open market, and all of which constituted the product of the Carnegie mills, were used in the construction of these cars.

Previous to this time the Schoen Pressed Steel Company, of Pittsburg, Pa., had for a number of years been manufacturing various parts for cars by pressing plates into special shapes. This company was the first to introduce a design of an all-steel self-clearing hopper bottom coal car built entirely from pressed shapes, these being built under patents issued to C. T. Schoen and J. M. Hansen. The prompt and extended adoption of the all-steel car is undoubtedly due to the aggressive policy pursued by this company and its successor in the introduction of its product. The designs for these cars were placed before railroad engineers shortly after the exhibit of the cars built at the Keystone Bridge Works for the Carnegie Steel Company. The Carnegie Steel Company, owning and operating the Pittsburg, Bessemer & Lake Erie Railroad, extending from Pittsburg to Lake Erie, decided to place in service on this road enough cars to thoroughly demonstrate the possibilities of cars built of steel, and early in 1897 placed with the Schoen Pressed Steel Company an order for 600 self-clearing steel hopper cars of 100,000 pounds capacity, it being specified that 400 of these cars were to be of the structural design originally prepared by the Carnegie Company's engineers, and 200 to be of the pressed steel design advocated by C. T. Schoen. At the time of the placing of this order, it may be interesting to note that there was no industrial establishment in the country specially equipped for the construction of steel cars, and the Schoen Pressed Steel Company was not able to turn out one complete car per day. Upon being awarded this order, however, those interested in the Schoen Pressed Steel Company, of which C. T. Schoen was the executive head, immediately arranged for the extension of its plant, and carried on the work

Digitized by Google

of enlargement simultaneously with the construction of the cars, with the result that the entire order for 600 cars was completed in nine months, the first car having been completed in June 1897.

Following the order of cars for the Pittsburg, Bessemer & Lake Erie Railroad, the Pittsburg & Western Railroad placed with the Schoen Pressed Steel Company an order for 450 pressed steel self-clearing hopper cars of 100,000 pounds capacity. These two orders marked an epoch in car construction and railway freight transportation, and the steel car industry was firmly established, and has since grown with phenomenal rapidity. As already stated, the cars for the Pittsburg, Bessemer & Lake Erie Railroad were of two different designs, one employing rolled sections and the other pressed shapes. As both were along radically different lines from previous designs of either wood or metal cars a general description of both types may prove of interest.

The cars designed by the Carnegie Steel Company were what is known as the hopper bottom type of car, the cubical capacity being about 1,400 cubic feet. The centre sills consisted of two 15-inch I beams, and the side sills were 12-inch channels with their flanges placed inward. No intermediate sills were used. The plates forming the sides of the car extended to the bottom of the side sill channels, and were riveted to the web of same. This latter form of construction was employed on the first sample car, but on later cars was modified by omitting the channel side sills and riveting an angle along the lower edge of the side plates, a second angle being riveted to the plates about 18 inches higher up, both angles extending the full length of the car. The body bolster was of a built-up latticed girder type, and the floor of the car was made up of inclined steel plates and a crosshood placed at the centre of the car. This car weighed about 37,150 pounds. The car made of pressed steel was similar in general appearance to the above described car, but differed materially in the details of construction. The centre sills were made of plate, pressed to channel form, being 17 inches deep at the centre and tapering to 10 inches deep at the bolsters. The side sills were of similar construction, and the side plates were flanged at both top and bottom, the bottom flanges being riveted to the top flanges of the side sills. The body bolsters also were of pressed steel, being trough-shaped in form. This car weighed about 34,350 pounds.

At about the time the order for the Pittsburg, Bessemer & Lake Erie cars was placed the Pittsburg & Lake Erie Railroad was designing a hopper car along somewhat similar lines to the cars designed by the Carnegie Steel Company, and a sample car in accordance with these designs was built by the Youngstown Bridge Company, this car being completed and placed in service about March of 1897. In this car the centre sills consisted of 15-inch I beams, the sides of the car being built-up plate girders, with diagonal reinforcing angles extending from top to bottom and stiffening angles extending the length of the sides being riveted to the upper and lower edges, thus forming a girder which was designed to carry the entire load. In order to reduce the weight of the car the side sheets below the floor line, from the bolsters to the ends of the car were cut out. This car was of 100,000 pounds capacity, and weighed 35,500 pounds. No pressed shapes whatsoever were used in its construction.

Up to this time all the cars built by the Schoen Pressed Steel Company were of the hopper bottom type, but the value of steel in freight car construction having been fully demonstrated, orders for other types followed in rapid succession, so that to-day practically all forms of freight cars, including hoppers, flat bottom gondolas, flat and ballast cars, have been constructed from steel in large numbers.

The adoption of the idea of maximum train loads, and the consequent enormous increase in the tractive power of the locomotive, served to further increase the popularity of the steel car, as it early became evident that the draft rigging and underframe construction of the wooden car would prove inadequate for the severe service to which they were subjected. As a consequence many cars of the box, stock and gondola types were built with steel underframing, and having a superstructure of wood, as a substitute for the original all wood structure. Cars of this type have given very satisfactory results in service, as with the combination all the desirable features of the wooden body are retained, while the underframe is sufficiently strong to resist the most severe buffing and pulling strains. A further advance in the substitution of steel in cars of the combination type has recently been made by the use of steel posts, braces, plates and carlines as a substitute for those of wood, thus producing a complete steel frame car.

The successful results obtained from the introduction of rolled steel as the basic material in many large engineering enterprises warranted its careful consideration in the infancy of steel car construction, and when the Carnegie Steel Company specified that the major portion of its first order for steel cars was to be constructed of rolled section, it is evident that from the very beginning it was recognized that the ideal car would be one made throughout of standard commercial shapes. As pressed steel, however, admitted of the production of shapes of the exact form desired, and the early development of the steel car being in the hands of those predisposed in favor, and interested in the manufacture, of pressed steel parts, it is natural that great progress was first made in the perfecting of this latter type of construction, while the car made of rolled sections remained for the time in its original crude state, being clumsy and heavy when compared with the more highly developed pressed steel car. The advantages of constructing a car from a few standard commercial shapes, easily obtained in the open market, especially when considering the question of repairs, rather than from numerous special parts, requiring expensive machinery in their manufacture, were too manifest, however, to permit of being long ignored, and that it was possible to build cars from standard rolled sections, having all the advantages of light weight and maximum strength claimed for the pressed steel car, has been fully demonstrated by the later developments of the art, and is amply evidenced by the numerous structural steel cars now in service which compare favorably with the pressed steel types in the matters of lightness, strength and simplicity of construction.

Digitized by Google

With the increasing demand for the steel car it is natural that a very inviting field for the investment of capital was disclosed, with the result that we have to-day in the United States four large corporations actively engaged in this line of manufacture. The yearly capacity of these companies, taking the year 1903 as a basis, is approximately as follows:

Pressed Steel Car Co.	30,000	steel cars per annum
Standard Steel Car Co.	24,000	" " " "
American Car & Foundry Co.	10,000	" " " "
Cambria Steel Co.	4,000	" " " "

or a combined capacity of approximately 68,000 steel cars per annum. The total number of steel cars and cars with steel underframes built up to date aggregates approximately 150,000 cars, and represents an investment of approximately $150,000,000.

While the use of steel in car construction has up to this time been confined largely to the manufacture of cars for the transportation of freight, experiments are now being made towards adapting this style of construction to cars for the transportation of passengers, and it is believed that at no very remote period steel will prove as important a factor in the construction of this latter type of equipment as it has in the construction of equipment used exclusively in the transportation of freight.

J. M. Hansen,
President Standard Steel Car Company.

Steel Engraving, See Engraving.

Steel, Heat Treatment of. Steel is a material of very varying properties, and those properties by no means depend upon chemical composition alone. The physical structure may and does vary to a marked degree according to the heat treatment that the piece has undergone; and that the strength, toughness, and general usefulness of a structural member of steel may be largely controlled by the way in which it is subjected to the action of heat. Formerly it was assumed that phosphorus gives brittleness, that sulphur makes the metal red-short, and that the other properties are almost entirely dependent upon the percentage of carbon present. With the introduction of the microscope and the use of the methods of metallography in the study of steel and other alloys, it has been found that the structure and the properties of the material may be largely modified without any change whatever in the chemical composition, and as a consequence some very practical lessons have been learned. When steel of a coarse structure, but not necessarily brittle, is heated to a certain temperature and is then allowed to cool in air, or is quenched in oil or in water, the original structure is destroyed, and is replaced by one of a very fine-grained character. Pure iron, when so coarsely crystalline as to resemble cast zinc, may be restored to excellent qualities by simply heating it to a certain temperature (known as the «critical point»); its subsequent structure resembling that which it possessed when it originally left the rolls. The old idea of the process of annealing was to reheat the material to a high temperature, and then to hold it for a time at that temperature, and subsequently to cause it to cool very slowly; but recent researches show that the temperature of reheating must not exceed 1,650° F., and that the time of cooling has little or no influence upon the result. It is altogether unnecessary to reheat and reforge the specimen, and, in fact, the material is apt to be still further injured by such a process. Since almost any piece of structural steel is liable to be rendered more or less crystalline during the operations through which it is necessarily passed, it is most desirable that the process of restoration be made a regular portion of the routine of manufacture. To permit this it is only necessary that proper furnaces be designed to admit the large pieces, and to permit a uniform temperature to be maintained in all parts, reliable pyrometers being of course provided so that the correct temperature may be maintained. The operation may then be performed upon every piece as the final stage in its manufacture. The result would be the complete elimination of danger of accident from weakness by crystallization. The microscope indicates that heating at high temperatures causes a great development in the size of the crystalline grains, and that reheating to about 1,600° F., restores the original structure, or yields an even better one. A structural steel, although good in its normal rolled or forged condition, may easily deteriorate by being heated to a temperature a little above that to which steel is most commonly heated, previously to being rolled or forged. Steel that is made brittle by such heating, or dangerously brittle by exposure to considerably higher temperatures, can be completely restored to the best possible condition without remelting and without forging down to a smaller size. Practically all of the experimental results show, not only that the original good qualities of normally rolled steel can be restored after the material has been made brittle by the exceedingly simple expedient of heating to about 1,600° F. for a very short time, but also that the steel may even be made better than it was originally.

Steel Industry in the United States, History of. To relate the entire history of the steel industry in the United States it is only necessary to go back as far as 1786, for it was in that year that the legislature of Pennsylvania voted to loan a Mr. Humphreys an amount that was equivalent to $1,500, for a term of five years, to enable him to continue his attempts to make bar iron into steel "as good as in England." It was by such means that the old Keystone State took the lead in all matters relating to the steel industry in the new Republic, and she has continued to hold this position up to the present day. In 1810, when the entire country succeeded in producing scarcely more than 900 tons of steel per annum, Pennsylvania's share was 531 tons, or more than one-half of the whole amount, and there have been few, if any, occasions during the entire development of the art of steel making that she has not maintained about the same percentage.

By 1830, the manufactories of steel had attained a total production of 1,600 tons per annum, but as this amount was equal to the quantity imported those who were interested in the growth of the home industry felt that the American producers would do very well if they were able to continue to divide the market with the foreigners. Of course, this was fully three-quarters of a century ago, when practically the only kind of steel that was made was by cementation.

The period between 1831 and 1860 saw little

Digitized by Google

STEEL PRODUCTION IN THE UNITED STATES.

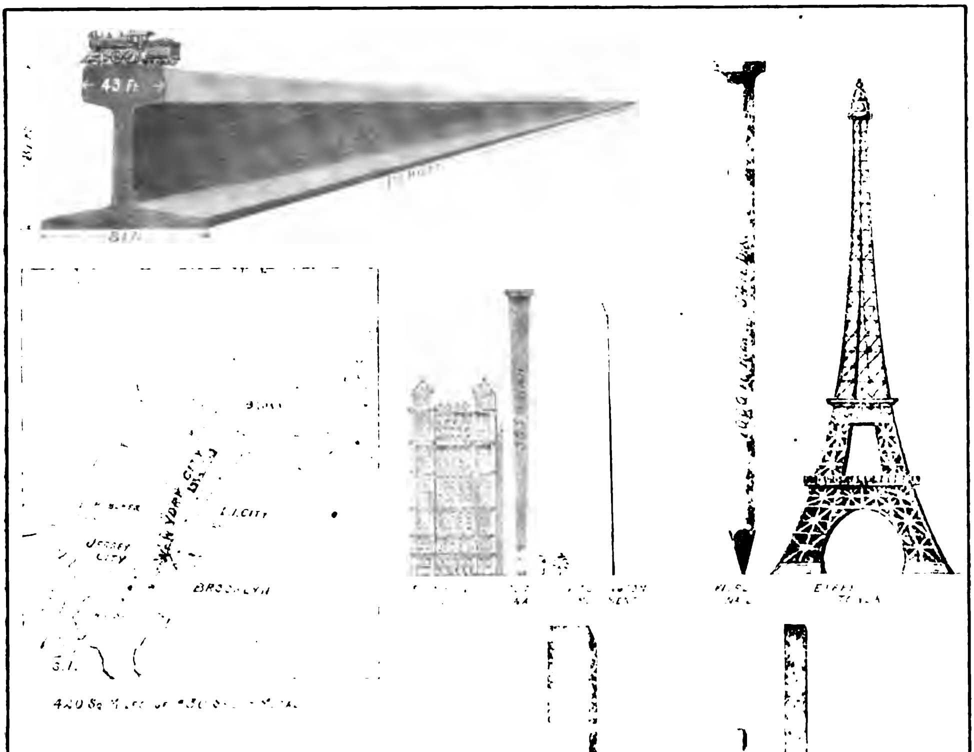


DIAGRAM SHOWING ANNUAL PRODUCTION OF RAW AND FINISHED MATERIALS OF THE IRON AND STEEL INDUSTRY.

Digitized by Google

Digitized by Google

progress in the development of the steel industry in America. In 1850 the total production of the country was scarcely 6,000 tons, and it still consisted chiefly of blistered steel. Of course, during this time new industries were constantly being established, but, generally, they were such small plants that their output did not materially swell the country's aggregate production. In 1840, for example, a successful steel manufactory was opened by Isaac Jones and William Coleman, in Pittsburg. Three years later the firm of Singer, Nimick & Co. began to produce the various grades of cast steel that were required in the making of saws, machinery, etc., and they, too, were successful. The first crucible steel of good quality to be produced as a regular product from American iron was made by Hussey, Wells & Co., in 1850, and they remained the largest manufacturers until 1862, when Park Brothers & Co. established their big steel plant and imported several hundred English workmen to teach American labor the best and cheapest methods of producing steel. All these concerns were located in Pittsburg.

It was in this manner that the American manufacturers began their struggle against the producers of foreign steel, a struggle for the control of an ever-widening home market and which was to end only when the invader had been finally driven from the field.

The United States has been the battle ground for many a strenuous struggle for commercial supremacy, but none of these contests have been more interesting than that which was waged for the control of the steel market. In the beginning the foreign producers had everything their own way. Having a surplus product with which to operate, they calmly proceeded to «dump» this surplus upon the American market at prices by far too low to permit of local competition. By sending only their surplus product to the United States they were able to realize sane prices upon their original output, whereas the low prices at which they marketed the surplus part of their product compelled the American producer to dispose of his entire output at the same extremely low rates or else admit his inability to compete with the foreign invaders.

It was a bitter struggle and it lasted for many years, but to-day it is the American manufacturer who is «dumping» his surplus into foreign territory. Taking a lesson from the English producers the American manufacturer went to work to build up a profitable home market. With that advantage under his control he was then able to think about the invasion of the foreign market, and, when the day came, the foreign manufacturer awoke to a realization of the fact that his American rival has ceased to be the «under dog», but that, instead, he had become a formidable factor in international trade. The American manufacturer had learned a lesson which Andrew Carnegie once embodied in the form of this commandment: «First conquor your home market, and the foreign market will be added unto you.»

Of course, it must not be imagined that the establishment of a single plant like that of Park Brothers & Co. produced an immediate change in the steel situation in America. Although its effect was felt, it was not until two years later that the Iron Age began to give way to the new King, Steel. The first notable improvement was the production of Bessemer steel, a method which was first adopted in the year 1864. With this invention, however, steel that had hitherto cost from six to seven cents a pound for ordinary grades, could now be produced so much cheaper that it has since been sold at less than one cent a pound, while steel billets, sold by the hundred thousand of tons, have brought as low as two cents for three pounds of steel.

Such a condition could never have been attained if it had not been for the invention of Sir Henry Bessemer, for when one takes into account all the expenses which the production of steel represents the prices that are received for the product seem so low that one is scarcely able to imagine how the manufacturers are able to meet such costs and the natural risks of business and still be assured of any profit for themselves. Thus, for example, each pound of steel contains two pounds of iron ore, which must be mined and transported, either by rail or water, sometimes more than 1,000 miles; one pound of coke, which contains one and one-third pounds of coal, which must be mined, coked and transported to the steel plant, and one-third of a pound of lime stone, which must also be quarried and transported to the scene of operations. Thus a single pound of steel, which is sold to the consumer at two-thirds of one cent per pound, contains three and one-third pounds of raw material, a fact which clearly indicates that the cost of manufacture itself must certainly be reduced to a minimum.

Up to 1895 the Bessemer process reigned supreme, and it was only the intimate friends of Sydney Thomas who had the faintest suspicion that even this method was likely to be supplemented by an invention which would not only improve but materially reduce the cost of production. When the basic process came, however, and it was at last possible to make use of impure ores in the Bessemer converter, the older system had a worthy rival.

The first experiments with the open-hearth Siemens furnace were made in England, where they were watched with interest by representatives of the American manufacturers. When the Thomas basic process was announced, therefore, and it was found to be particularly well adapted to the open-hearth furnace, Cooper, Hewitt & Co. began to experiment with it in the United States. In the beginning, of course, the establishment of the open-hearth system entailed great expense, but while, at first, this necessitated its restriction to few uses, it was not long before the necessary improvements were made and the cost was so materially reduced that the new method was placed in a position in which it was possible for it to compete with the Bessemer process.

At the present time two kinds of steel are made in the open-hearth furnace. One is the acid, the other, basic steel, and, while the latter is much purer than the former, it is also much cheaper. In many instances basic steel is used as a substitute for Swedish iron, even in the manufacture of horseshoes. To manufacturers in the United States, one of its greatest advantages is due to the fact that ores containing high phosphorous — the ores of which we have such an enormous quantity in this country — may be used in making steel by the open-hearth method, whereas the Bessemer process necessitates the use of material which is comparatively free from such phosphoric qualities.

Digitized by Google

In fact, it was the introduction of the open-hearth method that enabled the South to take its present position as an important steel manufacturer. As its ores are notably unsuitable for the Bessemer process it would have been utterly impossible to have made any use of them if the old system of making steel had not been so widely superseded by the new method invented by Thomas.

It is only since the year 1895 that American manufacturers have attempted to export their steel to other lands, and yet to-day they represent one of the greatest sources of supply for the world's markets. Not only do they supply many of the foreign demands for steel, but they are an important competing force in the countless articles in the manufacture of which steel is a component part. During the past 10 years the cheapness of steel has resulted in its adaption to so many uses that, instead of being troubled to find a market for their product steel manufacturers are now beginning to wonder where the steel is to come from that will be required to supply the world's demands by the end of the 20th century. At the present time little steel is manufactured outside of the United States, except in Great Britain and Germany. Neither of these countries can increase present production very greatly as compared with America. So far as Russia is concerned, if she succeeds in supplying her own wants by the middle of this century she will have no just cause to complain, and there are no other countries that are capable of becoming a factor in the steel situation. From being an intruder in the foreign markets, therefore, the exports of American steel have become a necessity in almost every part of the world. In 1900 the exports of steel and the manufactures of steel to various parts of the world aggregated $119,000,000. What the aggregate will be by the time another census is taken one can only surmise, for the exports of steel must continue to increase steadily as long as the people in every part of the world persist in demanding the thousand and one articles of which steel is the base. It was not many years ago that the steel ship was regarded as such a preposterous proposition as to be entirely unworthy of serious contemplation, yet to-day our steel ships are plying the waters of every land, from almost every port. So, too, scarcely more than a dozen years ago there was not a ton of steel a year used in the making of railway cars, whereas, at the present time, more than one thousand tons a day are consumed in that purpose alone, and while, up to this period, the use of steel in car construction has been chiefly restricted to the making of such cars as were intended exclusively for the transportation of freight, the experiments that have already been made by the engineers selected by some of the great railway corporations, have shown so conclusively that the same material may just as well be adapted to the construction of cars for passenger conveyance, that it is safe to say that the next great increase in the demand for steel will come from some of the railroad shops that are engaged in making first-class passenger coaches.

If such demands continue to increase in number with anything like the frequency that they have shown during the past ten or fifteen years, the question of supply may not improbably become a matter of great importance, however lightly one may be inclined to treat it to-day. By an estimate that was made a few years ago, at the instigation of Mr. Carnegie, the experts declared that they had found evidences to indicate that the supply of ironstone in the United States was sufficient to meet all possible demands that the world might make upon us for at least half of the present century, while the store of coke in this country was estimated to be amply sufficient to meet the wants of the markets of the world until the year 2000. What is to happen after the beginning of the new century is one of those mysteries that time alone can solve. Of course, there is reason to believe that, from time to time, other mineral deposits will be discovered, and there is always the probability that science will rise to the occasion, just as it has done in other emergencies, to point the way out of what would otherwise have proved a serious tangle in the matter of an ever-decreasing supply and an ever-increasing demand.

At the present time the centre of the steel industry in the United States may be bounded by an imaginary square with lines extending from Pittsburg to Wheeling, northward to Lorain, then eastward to Cleveland, and thus back to Pittsburg again. Such a large percentage of the American steel is manufactured within this square that it will be many years before any other portion of the country can hope to compete with it. In 1900 Alleghany County alone produced not only one-quarter of all the pig-iron in the United States, but, also, nearly half of the open-hearth steel, and almost 40 per cent. of the total production of every kind of steel. It must be remembered, however, that Pennsylvania is not the only State in which the steel industry is now being widely developed. Both in the West and South large plants are in operation, and so many new projects are under way that both of these sections give every indication of becoming great steel centres. That Colorado will expand as the western country develops, as it is certain to do, is inevitable, while there is no further doubt but that Chicago will assume a most important position in the steel trade of the future. The selection of Buffalo as the location for the great plant of the Lackawanna Iron & Steel Works — at the time of their removal from Scranton, Pa. — was one of the first indications of the determined move toward the lakes. Their manufacturers can obtain the advantage of the extremely low charges for lake transportation, to say nothing of the facilities of the Welland Canal, by means of which vessels of considerable tonnage are able to load at the lake ports direct for Europe. In fact, there are several good reasons to believe that those whose business it is to ship heavy materials are looking with more and more favor upon water transport as a means of conveyance. Already huge lake craft of many thousand tons burden have been constructed; great barges are being built to ply upon the rivers, and this with the many canal improvements — those already made as well as those proposed and those under way — are excellent surface indication that the great steel manufacturers are carefully devising plans to take advantage of the water rates which are cheaper than those charged for rail transportation.

Of course, it is quite within the bounds of

Digitized by Google

1. A Circular Pig-iron Casting Machine. **2.** A Straight Line Pig-iron Casting Machine.

Digitized by Google

Digitized by Google

possibility that some better method of making steel may some time be discovered. It is also possible that improvements upon the present methods may cheapen the cost of the process. To steel men, however, there seems to be little room for much improvement or innovation. They agree with the prediction, that «the 20th century, with all its wonders yet to be revealed, will probably end with the manufacture of steel substantially as it is now — by the open-hearth process.»

ANDREW CARNEGIE.

Steel Nails. See NAILS; STEEL WIRE.

Steel Pipe. See PIPE, MANUFACTURE OF.

Steel Rails. See RAILS AND STRUCTURAL SHAPES.

Steel Structural Shapes. See RAILS AND STRUCTURAL SHAPES.

Steel, Testing of. Steel is tested not only for the purpose of determining its strength, but also to obtain a measure of several other important qualities such as malleability, ductility, and hardness, which gives it the first rank as a material for structural purposes. Of the three kinds of tests — tensile, compressive, and transverse or bending (see TESTING MACHINES), the tensile test gives the simplest and most accurate data from which those properties of steel most important in structural work may be most readily determined. A «heat» of steel is usually submitted to two tensile tests — the heat test, in which the metal is pulled apart; and the cold test, in which the metal in a cold state is bent over upon itself. At the mill the specimen to be tested is prepared so as to indicate the general properties of the metal, and its suitability to the purpose for which it is required, and upon the resulting data is based the treatment of the metal during the subsequent operations in the mill and at the forge. In selecting the specimen, great care is taken to secure one that is an average of the heat, so as to obtain uniform results, as nearly as possible, from the operations of heating, rolling, forging, and cooling. Very often, apparently inconsequential differences in the methods employed to select and prepare the test specimen, give very misleading if not absolutely erroneous information. Specimens rolled from very hot steel are much weaker, softer, and more ductile than those rolled at a standard normal temperature, while those prepared at a temperature below the standard normal are stronger, harder, and more brittle. Specimen test bars are usually three quarters of an inch in diameter, and about 20 inches in length. Before a test, the exact diameter of the specimen is measured to within 1,000th of an inch, by means of a micrometer caliper, and about 12 inches of its length near the middle is divided by light scratches or by centre-punch marks at intervals of an inch, from which the reduction in the area of the cross-section, and the amount of stretch under the pull of the load applied, is measured. In the testing machine, the effect produced on the specimen by the gradually increased load, varies greatly for different qualities of metal. Steel containing a large amount of carbon, of the quality generally used for the manufacture of springs, stretches slightly and uniformly up to the breaking point. In the case of softer steel, at the beginning as the load is gradually increased the metal stretches uniformly for a little while, but the period is much shorter than that of high carbon (harder) steel, then it stretches very rapidly for a few seconds, without any appreciable increase of the load, until it is apparently on the point of breaking, when it partially recovers its strength, and stretches slightly but uniformly as the load is gradually increased to the maximum. In the case of hard steel, the metal ruptures under the maximum load, but the soft steel continues to stretch for a little while beyond that point under a decreasing load, with a great reduction in the sectional area of the specimen. To determine the amount of elongation produced by the test, the fractured ends of the two pieces of the broken bar are put together and the increase in the lengths of the original inch spaces marked on the bar are measured. In very hard steel, the amount of elongation is very small, but even the hardest and most brittle varieties undergo a measurable change of length. In soft steel it is very great, varying from 25 to 30 per cent of the original length. The behavior of a specimen in the testing machine when subjected to a gradually increasing load is studied by means of a stress-strain diagram which consists of two sets of parallel lines intersecting each other at right angles. The horizontal lines represent the strains in pounds per square inch of the sectional area of the specimen, and the vertical lines represent the amount of elongation of the specimen at the rate of 0.01 per inch of the original length. When the data obtained by the test are plotted upon the diagram, the behavior of the specimen is indicated by a characteristic curve. Assuming an original length of 6 inches for a specimen the behavior of soft steel under a gradually increasing load may be briefly summarized as follows: Up to a load of 40,000 pounds to the square inch the elongation is very slight, about 0.01 of an inch in a length of 6 inches. From 40,000 to 43,000 pounds the elongation is more rapid, but the total amount is only 0.02 of an inch. From this point the metal stretches very rapidly with no increase of load until the elongation amounts to 0.15 of an inch, then it apparently regains some of its strength and stretches slowly and uniformly until the elongation amounts to 1.96 inch, or 33 per cent of the original length, under a maximum load of 63,000 pounds to the square inch. An analysis of these results shows that it would require a load greater than 40,000 pounds per square inch to induce a permanent set in the metal, and is, therefore, the value representing its «elastic limit,» or the limiting stress below which there is practically no change in the original length of the metal, no matter how often that stress may be applied or removed.

It is generally assumed that a constant proportion exists between stresses and strains. This relation is expressed by the term «limit of proportionality,» and represents the limit below which, each increase of a given amount in the load results in the same change in the length of the specimen. It agrees very closely with the elastic limit, but it is not considered an important factor in engineering calculations, while on the other hand, the coefficient or modulus of elasticity, based upon the theory of the proportionality between stresses and strains, and obtained by dividing the stress on each unit of area of the section by the resultant strain in

Digitized by Google

each unit of length, of a specimen, is extensively used in calculations pertaining to the deflection of beams and springs. The coefficient of elasticity for all grades of steel is practically the same, about 29,000,000, and very delicate measurements are required for its determination, so much so, that the values obtained by different observers vary considerably, and places its exact value very much in doubt. For similar reasons, the determination of the exact value of the elastic limit of a metal is a very difficult matter, and as a rule the values stated as the elastic limit, in the reports of tests of specimens, sent out from rolling mills, is really the "yield point" of the metal, or the point at which the specimen suddenly elongates without any increase of the load, and although it is not theoretically as correct a gauge of the property of the metal as the true elastic limit, it is really a more reliable guide to the manufacturer and user, on account of the ease and accuracy with which it is determined by simple practical methods, and the fact that in good engineering practice, structures are not intentionally designed to sustain a stress as high as the true elastic limit.

Relative to the ultimate or breaking strength of the metal, the tests show that the specimen continues to elongate under a decreasing load after the maximum load has been applied, so that owing to the reduced sectional area, the stress under which the specimen finally breaks is generally much less than the maximum, and represents the "tenacity," rather than the ultimate breaking strength of the metal. High elongation indicates a metal of good malleable and ductile quality, and if produced under a cold test, shows that the metal is especially suitable for boiler plate, rivets, etc. Another element considered in the tensile test is the character and appearance of the fracture. It often takes a form described as "cup" or "half-cup," in which one of the ends is wholly or in part concave, while the other is correspondingly convex. In other cases, especially with flat bars, the fractured ends are quite flat and smooth, but with their surfaces making an angle of 45° with the length of the bar, instead of a right angle, as in the case of the former. In hard steel, the surfaces present a rough crystalline appearance, while in soft steel, they have the glossy appearance of woven silk, or bundles of fine silk fibres. Although the character of the fracture is always noted in connection with the other data derived from the test, it is seldom made an important requirement in specifications owing to the impossibility of determining a fixed standard of comparison.

Cold bending tests are useful for the purpose of determining the ability of steel, or any other metal, to withstand severe distortion, when the metal is cold, under such operations as punching, shearing, flanging and riveting, usually employed in the manufacture of bridge members and structural shapes in general. The test does not require an expensive or elaborate plant for its application, and is therefore available where more complete tests are impracticable. On the other hand, however, it is very difficult to deduce accurate conclusions from the data obtained, owing to a lack of proper classification and standards of comparison. In making the test, the metal in each case is bent over upon itself through an angle of 180°. The inner radius of the bend varies from 0, in steel with a tenacity less than 62,000 pounds per square inch, to the "thickness of the specimen" in steel with a tenacity not greater than 70,000 pounds per square inch. The specimen is required to stand the bending without fracturing on the outside of the bend. The tests of finished steel are similar to those made in the mills during the process of manufacture, with the exception of the methods employed in the preparation of the test specimens. These are cut directly from the finished product in the form of rectangular pieces, 20 inches in length, in the larger kinds of work, while small bars are generally tested full size.

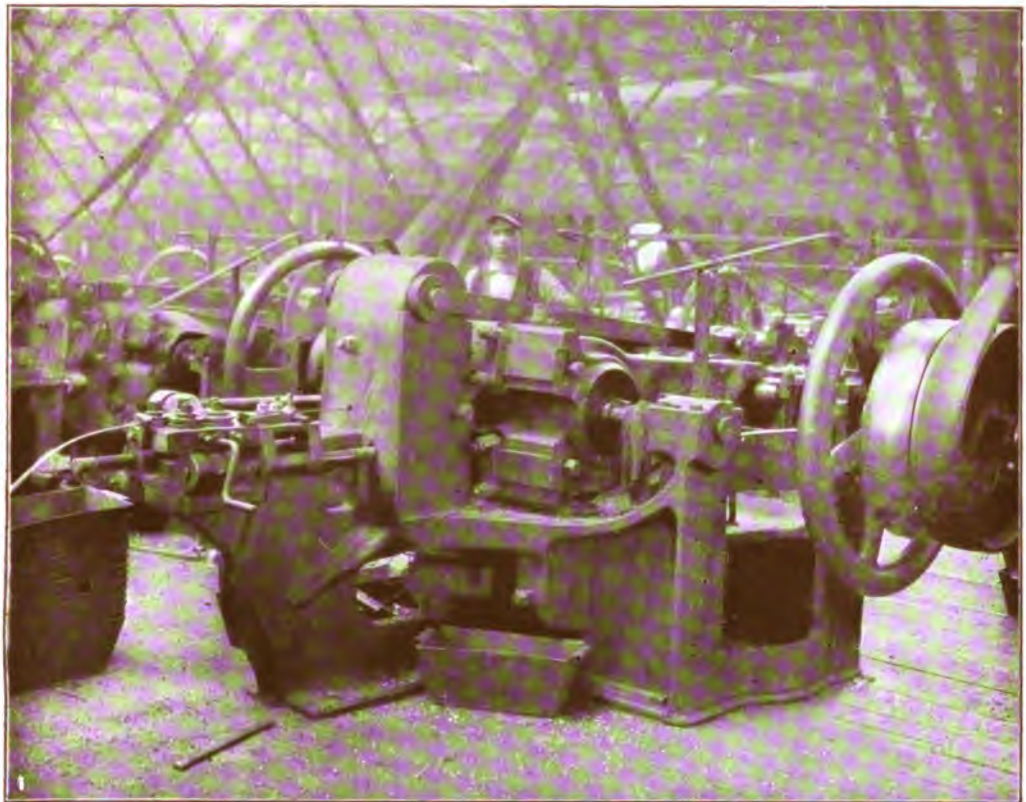
W. Morey, Jr.,
Consulting Engineer.

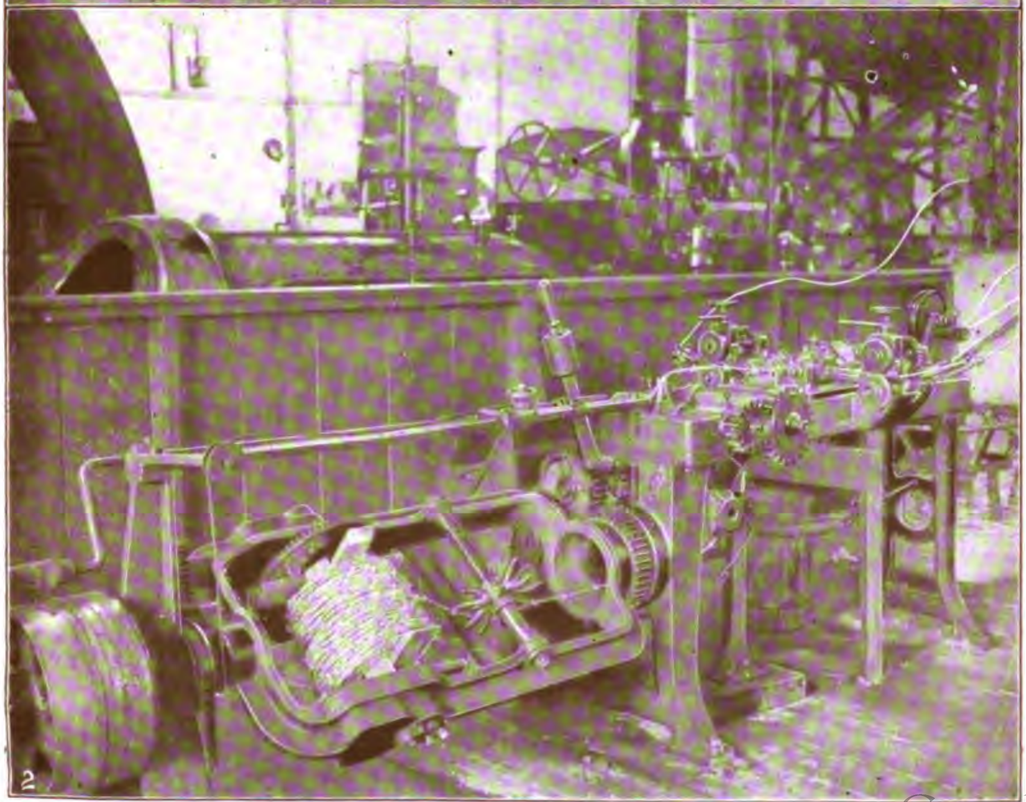
Steel Tube. See Pipe, Manufacture of.

Steel Wire and Nail Making. The importance of the steel wire and nail industry in the United States may be measured by the fact that in 1902 there was produced a total of 1,574,293 tons of wire rods of which nearly 500,000 tons were made into wire nails. Time was when both wire and nails were manufactured entirely from wrought iron, and to secure the toughness and high tensile strength required, great care had to be used in the preparation of the iron, the cost of the product being proportionately high. It was only a question of time before steel, because of its less cost and its high strength, became the standard material in this as in other branches of the iron and steel industry; and to-day practically the whole of the wire and wire nails used are made from either Bessemer or open-hearth steel, the latter being specified where wire of the special grades with higher physical properties is required.

Physical Properties of Steel Wire.— As showing the great increase in strength of steel over iron wire, it may be mentioned that while good black iron wire will show an ultimate tensile strength of about 25 tons to the square inch, and bright hard-drawn wire a strength of 35 tons to the square inch, Bessemer steel wire will stand a strain of 40 tons and open-hearth steel wire 60 tons to the inch. Of the "special" grades of wire a high-carbon open-hearth steel will stand about 80 tons, crucible cast-steel wire about 100 tons, and the best cast steel, or as it is sometimes called, "plow" steel wire, 120 tons to the square inch; while certain qualities of cast-steel wire, made under specifications calling for a particular composition, and requiring very elaborate working, have been produced, showing an ultimate breaking strength of from 150 to 170 tons to the square inch. The process of wire drawing serves to greatly improve the physical qualities, and the smaller the size to which the wire is drawn down, the greater is the ultimate breaking strength. The wonderful qualities of piano wire are proverbial, the average strength of English piano wire as given by the manufacturers ranging from 225 pounds for No. 12 music wire gage, which is 0.029 inch in diameter, to 650 pounds breaking strength for No. 22, which is 0.052 inch in diameter. Reduced to the square-inch unit, the ultimate tensile strength per square inch would range from 300,000 pounds to 340,000 pounds. The composition of this remarkable wire is as follows: Carbon, 0.570; silicon, 0.090; sulphur, 0.011; phosphorus, 0.018; manganese, 0.425. An analysis of another wire of unusual strength known as "plow," showing 0.828 per cent of carbon, 0.587 per cent of man-

Digitized by Google





1. Wire-nail Machine, Capacity 150 60-D Nails per Minute.
2. Machine for Making Barbed Wire.

Digitized by Google

Digitized by Google

ganese, 0.143 per cent of silicon, 0.009 per cent of sulphur, 0.030 per cent of copper, and no phosphorus. The tests of this wire ran from 200,000 pounds per square inch for wire 0.191 inch in diameter to 350,000 pounds for wire 0.093 inch in diameter. Of course, with such high tensile strength the elongation or stretch was very small, ranging from 0.75 to 1.1 per cent only.

Billet Yard.— The bulk of the wire and wire nails of commerce are manufactured from Bessemer billets. Open-hearth billets are worked up into rods for the manufacture of chain, for special grades of wire, and for various finished products in which high tensile strength is called for. In each rod mill billet continuous-heating furnaces are continually at work. The billets, which are 4 x 4 inches in section and 36 inches in length, are fed transversely into the furnace, side by side. They are pushed through the furnace door by a hydraulic charging machine, and by the time they have been heated to the proper temperature for rolling, they are pushed, one after the other, out through the rear door of the furnace, and fall upon a conveyor, by which they are carried down into the rod mill.

Roughing Mill.— The roughing mill consists of eight pairs of rolls, in which the billet is reduced from a 4-inch x 4-inch section to a three fourth inch square section, and it is in this mill that the steel receives the first instalment of that thorough mechanical working which contributes so greatly to its ultimate tensile strength. Each pair of rolls is placed at an increasing distance from the one that precedes it, in order to allow for the increase in length due to the decrease of section of the billet. It has been found, moreover, that by changing the shapes of the grooves in the successive pairs of rolls, making them alternately square and oval, oval and round, etc., there is not only an economy of power secured, but a more thorough working or manipulation of the metal is obtained, and its qualities are proportionately improved. In the eighth set of rolls, or "pass," as it is technically known, the grooves are three quarters of an inch square. From these, the last pair of roughing rolls, the rods are carried to the finishing mill.

Finishing Mill.— In this mill the wire rods are given ten more passes and brought down to the required dimensions. The finishing mill generally lies at right angles to the roughing mill; and instead of the rods passing through pair after pair of rolls in a continuous straight line, they pass through the successive rolls in alternating directions, describing half-circles between each pair. In order to guide the rods into the proper rolls, workmen stand between each pair, and as the rod issues from the rolls it is seized with a pair of tongs, bent around through a half-circle and fed to the next "pass." Consequently, when a rod mill is in full blast, it presents one of the most curious and attractive sights that can be seen in any rolling mill. Owing to the rapid decrease in section and increase in length, as the rod passes through the successive rolls, it is necessary that the speed of the successive rolls be increased; and by the time the rod issues from the tenth roll of the finishing mill, it is traveling at a speed of 1,350 feet per minute, or about 15 miles an hour. As the whole of the rolling down from the 4-inch x 4-inch billet to the finished rod, which will be, say 13-64 of an inch in diameter, is done at one heat, it can be understood that the scene is extremely picturesque. In order to protect the men who stand between the pairs of rolls and direct the course of the rods, a series of curved semicircular guards or shields are fastened upon the iron floor of the mill. The amount of working to which the steel is subjected, and the great horse power that is required to perform this duty, may be judged from the fact that the billet, which at the first pass through the mills was 4 inches x 4 inches in section, and only 3 feet long, as it issues from the last pair of rolls is a scant quarter of an inch in diameter and measures no less than 1,189 feet, or not far from a quarter of a mile in length. As the rods leave the last pair of rolls, the ends are caught up and attached to the drums of a set of reels, on which they are wound up into a convenient coil for further handling. As soon as the coil is completed, it is dropped from the reel onto the floor of a conveyor, by which it is carried to the wire mill.

Wire Drawing.— Up to this point the product is known by the technical name of "rods," and it is only after it has been drawn down in the dies that it is known commercially as "wire." Wire drawing has the advantage of permitting the production of a much smaller wire than could be produced under the rolls, while the very process of drawing down the wire greatly enhances its physical qualities, increasing the tensile strength to a truly remarkable degree. The wire-drawing machine consists of a stout bench, on which is mounted a strong cast-iron drum, on which the wire is wound as it is drawn through the plate. The draw plates, or die plates, as they are called, are stout blocks of cast steel which are perforated with conical holes, carefully gauged to the exact desired size of the wire. The holes have a slight taper, the wire, of course, entering at the larger end of the hole. The coil of wire is placed on a spool located on the floor of the shop near the bench, and the end of the wire having been swaged down, it is passed through the die plate and attached to the drum, which then proceeds to wind up the wire until the whole coil has been drawn down. As the wire drawing is done cold, it can be well understood that with several score of these machines running at the same time, it requires very powerful motive power to drive the mill. After it has been drawn down, it is necessary to remove the strains in the wire, and it is accordingly taken to the annealing room, where it is loaded into large annealing pots. After the pot is filled, it is carefully sealed with sand to exclude the air, and the wire is exposed to a steady heat for a period of from eight to nine hours. Of the total product, part is now ready for the open market without any further treatment, a small portion of it is sent to the galvanizing room to be galvanized, and a large proportion of it goes to the nail mill to be made up into wire nails or barbed wire.

Nail Mill.— In the nail mill each separate machine is capable of turning out from 150 to 500 finished nails per minute. In front of each machine is a reel, upon which the coil of wire is placed. One end of the wire is led into the machine, and as the power is thrown on, one sees the wire disappear through a small hole in the massive vertical casting; while to the accom-

Digitized by Google

panimentof a rapid succession of blows, a stream of the finished wire nails begins to pour out of the side of the machine into small iron boxes placed to receive them. The wire first passes between two pairs of horizontal, grooved wheels, which are pressed firmly together to give the required tension to the wire as it is drawn into the machine after each finished nail has been formed and cut off. The nail is pointed by the action of a pair of pliers with V-shaped cutting edges, and the head is formed up by the action of a very powerful cam-operated member, which strikes a hammer-like blow. As each nail is finished, the wire is gripped, and enough of it drawn forward to form another nail. The 3-D fine nails are turned out at the rate of 500 per minute, and the large 60-D nails at the rate of 150 per minute. The boxes of finished nails are covered up and taken to big, revolving iron cylinders, known as rumblers, where they are rolled over and over, the nails being thrown against each other and against the sides of the cylinders and receiving that high polish which characterizes the finished product. The time during which they are treated in the rumblers varies according to the size and quality of the wire. A certain amount of sawdust is also used during this process, in order to clean the nails thoroughly of grease and dirt. The nails are then loaded into 100-pound kegs, stenciled with the size and weight of the nails and the makers' name, and taken to the warehouse.

Barbed Wire.— In the barbed wire shop back of the "barb" machine are placed four coils of wire, carried on reels. The wire from two spools serves to form the strands, and the wire from the other two spools is used for the "barb." The two strand wires, which are heavier than the others, are led between a pair of friction wheels, and drawn to proper tension. They are then met by the two other strands, which are led in transversely, one on either side. At stated intervals of a few inches, according to the spacing of the barbs, a pair of revolving fingers catch the two barb wires and give them a twist around one of the strand wires, and at the conclusion of the twist two pairs of shears cut the ends of the barb diagonally, giving them the desired sharp points. The two wires next pass downwardly around an idler, and then horizontally into a combined winding and twisting frame. The frame itself revolves on a horizontal axis parallel with the machine, and serves by its revolution to twist the two strands. On a shaft arranged transversely within this frame is carried the barbed-wire spool, on which the finished product is wound ready for the market. When it is once started, the operation is continuous and extremely rapid. See also STEEL MANUFACTURE.

Steel-wool, a material largely used as a substitute for sand paper or emery paper, for polishing metal or wood surfaces. The material is composed of sharp-edged steel threads, curled like wool.

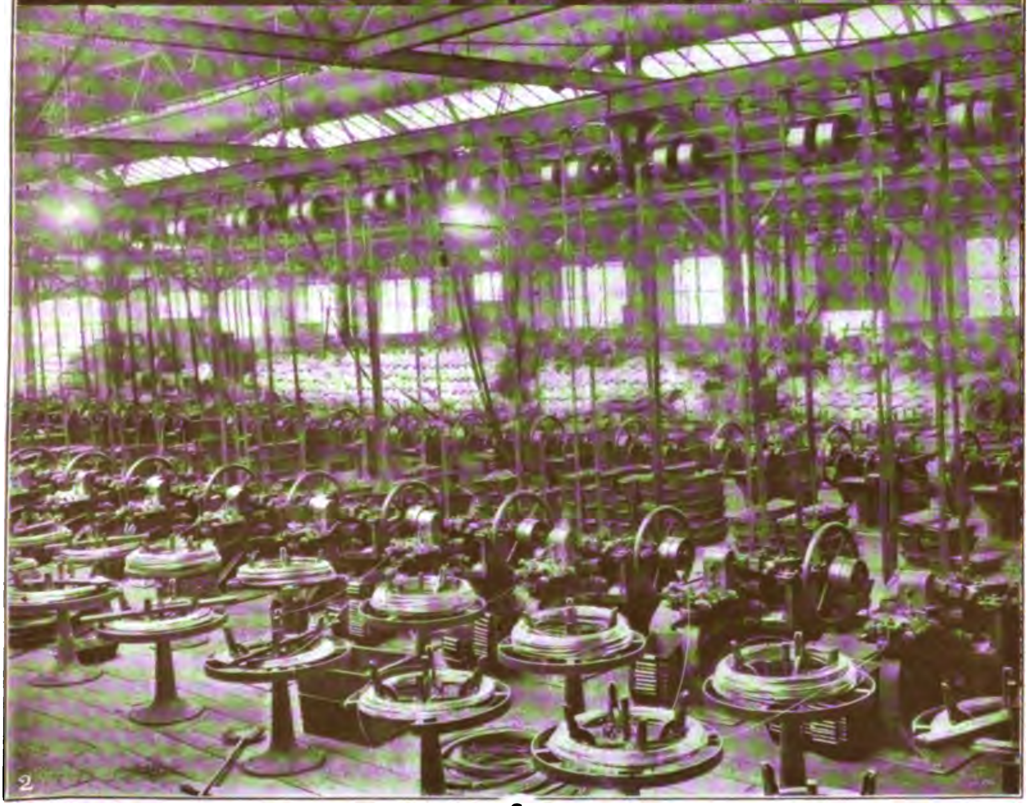
Steel-yard. See BALANCE.

Steele, stēl, **Flora Annie Webster,** English novelist: b. Harrow, Middlesex, 2 April 1847. She lived in India until 1889, was provincial inspector of government and aided schools in Punjab, and for several years a member of the educational committee. She was married to a Bengal civilian in 1867. Her publications include: 'Wide-a-Wake Stories' (1884); 'From the Five Rivers' (1893); 'Tales from the Punjab' (1894); 'On the Face of the Waters' (1895), a work of much power; 'The Hosts of the Lord' (1900); 'Voices in the Night' (1900) etc.

Steele, SIR **John,** Scottish sculptor: b. Aberdeen 18 Sept. 1804; d. Edinburgh 15 Sept. 1891. He received his art education in the Royal Academy, Edinburgh, and also in Rome. In the competition for a statue of Sir Walter Scott he was chosen to execute the seated figure for the Scott Monument in Edinburgh, and from the time of its unveiling (1846) his professional success was assured. Among his better known works, also in Edinburgh, are the statues of Wellington (1852), Prof. Wilson, Allan Ramsay, Thomas Chalmers, Queen Victoria, and the Scottish memorial to the prince consort, on the completion of which (1876) the artist was knighted.

Steele, SIR **Richard,** British author: b. Dublin March 1672; d. Carmarthen, Wales, 1 Sept. 1729. He left Oxford without taking a degree, for some time rode as a private trooper in the dragoon guards, obtained an ensigncy in the foot guards, and wrote as his first comedy, the 'Funeral,' or 'Grief à-la-mode,' which was acted in 1701, with considerable success. Through the recommendation of Addison, whom he had known at Charter-house, he was appointed, in the beginning of the reign of Anne, to the post of writer of the London 'Gazette.' His comedy of the 'Tender Husband' (in which Addison had some hand) appeared in 1703, and his 'Lying Lover' in 1704. In 1709 he began the periodical paper so celebrated under the title of the 'Tatler' (q.v.). The majority of the papers in this periodical are by Steele, but a considerable number are wholly or partly by Addison, and one or two by other writers. Early in 1711 the 'Tatler' was succeeded by the still more celebrated 'Spectator' (q.v.). The 'Spectator' terminating, Steele commenced, in March 1713, the 'Guardian,' which was followed in October of the same year by a political periodical called the 'Englishman.' By this time he had taken to active political life, having been returned to Parliament as member for Stockbridge in August 1713. In March 1714, he was expelled the House for an alleged libel in the last number of the 'Englishman,' and in another paper called the 'Crisis.' On the accession of George I. he received the appointments of surveyor of the royal stables, and governor of the king's comedians, and was knighted (1715). He had again entered the House of Commons as member for Boroughbridge. Always engaged in some scheme or other, few or none of which succeeded, he wasted his regular income in the anticipation of a greater, until absolute distress was the consequence. In 1720 his patent as governor of the royal comedians was revoked. He appealed to the public, in a paper called the 'Theatre,' which he had begun to publish at the beginning of 1720, a week or two before the event referred to. He was restored, the following year, to his authority over Drury Lane Theatre, and soon after wrote his comedy of the 'Conscious Lovers,' on a hint from Terence. This piece he dedicated to the king, who rewarded the author with £500. See the 'Life' by Aitken (1889).

Digitized by Google



1. Wire-nail Warehouse, capacity, 7,000 tons.
2. Wire-nail Making. 8,000 tons per month made in this shop.

Digitized by Google

Digitized by Google

and by Dobson (1886), who also edited 'Selected Works' (1885).

Steelhead, a fish. See SALMON.

Steelton, stēl'tŏn, Pa., borough, Dauphin County; on the Susquehanna River, the Pennsylvania Canal, and on the Philadelphia & R., and the Pennsylvania R.R's; three miles east of Harrisburg. An electric line connects the borough with Harrisburg. In 1866 the place was laid out under the name of Baldwin; later it was called Steel-Works P. O., and in 1880 it was incorporated under its present name. The chief industrial establishments of the place are owned by the Pennsylvania Steel Company, who have bridge and construction works, several blast furnaces, and rail and blooming mills. Other manufactories are lumber mills, several flour mills, brick works and machine shops. The public school was erected by the Steel Company. The national bank has a capital of $75,000. Pop. (1910) 14,246.

Steen, stān, **Jan Havickz**, Dutch painter: b. Leyden 1626; d. 1679. He studied under Nicolas Knupfer, Van Ostade, and Van Goyen, and married the daughter of the latter. From the conflicting accounts of his career it appears that he was at one time a tavern-keeper, and the tradition is that he led a drunken and dissolute life; but in disproof of this his numerous paintings attest that he must have been a laborious and careful worker. He stands in the foremost rank among Dutch painters alike as regards execution, composition, and color, and the action, gestures, and expression of his figures; while his composition is always full of spirited suggestiveness and genial humor. In the British National Gallery he is represented by 'The Music Master,' but his chief paintings are to be seen in the galleries of The Hague and Amsterdam. Consult Van Westrheene, 'Jan Steen, Etude sur l'Art' (1856).

Steendam, stān'dām, **Jacob**, Dutch poet of New Netherland: b. Holland 1616; d. (possibly in Batavia) after 1671. He was for 15 years in the employ of the West India Company; in 1641, while in its service went to Guinea, where he was present at the capture of Fort Axem from the Portuguese; returned in 1649 to Holland; and in 1649–50 published in 3 parts a collection of his poems as 'Den Distelvink' ('Thistle-finch,' or 'Gold-finch'). About 1652 he went to New Netherland. The colony was then harassed by encroachments on the part of New England, and Holland was quite indifferent to its welfare. Steendam then wrote (1659) 'Klagt van Nieuw-Amsterdam' ('The Complaint of New Amsterdam'), the first bit of verse written, so far as is known, in the colony. This with two other poems by him, may be found in Murphy's 'Anthology of New Netherland' (printed for the Bradford Club 1865). Steendam belonged to the school of Jacob Cats; his verses are rugged and often crude, and for their literary merit simply would claim no great attention. He had left the colony by 1663, and in 1665 went to the East Indies. Consult the above-mentioned work by Murphy, which contains a memoir and parallel verse-translations.

Steenstrup, stān'stroop, **Johann Iapetus Smith**, Norwegian zoologist and archælogist: b. Vang 8 March 1813; d. Copenhagen 20 June 1897. From 1845 until his retirement from active duties in 1885 he was professor of zoology and director of the zoological museum at Copenhagen. He was a busy investigator and wrote treatises on a wide range of subjects, from parasitic crabs and the change in the position of the eyes in flounders, to peat-bogs and the prehistoric remains known as kitchen-middens. He wrote also: 'Yak-Lungta Bracteaterne' (1892).

Steenwyck, stān'vīk, **Henrik van**, Dutch painter: b. Steenwyck 1550; d. Frankfort-on-Main 1603. He excelled in the execution of church interiors and was a master of both linear and aerial perspective. His son, Hendrik, called "the young Steenwyck," was born about 1589, and became the friend of Vandyke, for whom he is said to have painted architectural backgrounds. He died in London, in what year is unknown, but it must have been subsequently to 1647.

Steeple, in architecture, any tower-like structure attached to a church, whether a tower proper or spire or a combination of tower and spire or tower and lantern. See SPIRE.

Steeple-bush. See HARDHACK.

Steeplechasing, so called from the fact that the riding involves steep hill climbing or that the riders had a distant church steeple as a goal which they reached regardless of the country over which they might be obliged to travel. Steeplechase racing is most exciting as the obstacles over which the horses are obliged to jump necessitates great danger. The Great National Steeplechase of Liverpool is a great English racing event. It was established in 1839. The Meadowbrook Club in the United States is the pioneer of steeplechasing.

Steerage, in passenger steamships, the name given an apartment which is separated from the other cabins by a partition or bulkhead. The steerage is assigned to the cheapest class of passengers. Steerage is also used to express the effort of the helm. Steerage-way implies a sufficient degree of motion communicated to a ship for her to become susceptible of the effects of the helm in governing her course.

Steevens, stē'vĕnz, **George**, English Shakesperian critic: b. Poplar, London, 10 May 1736; d. Hampstead 22 Jan. 1800. He was educated at Eton and King's College, Cambridge, but did not take a degree, and in 1766 published 'Twenty of the Plays of Shakespeare' in four volumes. After this he was associated with Dr. Johnson in an edition of Shakespeare published in 1773. He then prepared (1793) a corrected text, with notes of the dramatist's works in 15 volumes, which long remained the standard edition. He made many enemies by his acrimonious and ill-natured attacks on contemporary editors and others, but his contribution to Shakespearian criticism has permanent value.

Steffani, stā-fā'nē, **Agostino, Abbate**, Italian composer: b. Castlefranco, Venice, 1655; d. Frankfort-on-Main 1730. He received his musical training in Venice and Munich in which latter city he was appointed Director of the Grand-ducal Concerts (1681); and after the production of his opera 'Servio Tullio' in 1688, chapel master to the court of Hanover. In that capacity he did much to improve the religious music of his day. His Italian operas, which

Digitized by Google

were produced with brilliant stage setting at Herrenhausen Castle, were also translated into German and performed at Hamburg (1690). Fine as are his operas, his chamber music, much of it set to Italian words, is even richer in melody and tonal expression. Later in life he became more and more engrossed in his diplomatic duties, resigned to Handel his office of chapel master (1710) and was appointed councillor by the Grand-duke Palatine, and, by the pope, prothonotary and Bishop of Spizza (*in partibus*). He applied himself henceforth to his civil and religious functions, in pursuance of which he made his last visit to Italy in 1729. Those works of his which have been printed include: 'Psalmodia Vespertina, for Eight Voices' (1674); 'Sonate da Camera a due violine, alto e continuo' (1679); 'Duetti da Camera a soprano e contralto' (1683); etc.

Steg"ocepha'lia, one of the primary divisions of the amphibia, sometimes considered as a sub-class, sometimes as an order, especially characterized by the great development of dermal or superficial bones on the dorsal surface of the head. Being totally extinct and consequently known only from their skeletal remains many questions concerning their relationships remain open. Many of the stegocephali were of salamander-like form, with broad, flattened head, simple, weak paired limbs of the typical pentadactyl type and a more or less elongated tail. Some were lizard-like with stronger limbs. Some, like *Ophiderpeton,* lacked limbs and were serpentine in form. Many are known to have passed through branchiate larval stages and some, like the *Branchiosauridæ,* retained the gills throughout life. Many of the large labyrinthodonts had rudimentary tails and must have been somewhat frog-like in aspect. One remarkable form, the *Dissorophus multicinctus* from the Permian formation of Texas, is described by Prof. Cope as having borne an armadillo-like carapace on the back. The roofing bones of the head were numerous and covered the temporal fossa as well as the cranium. In some of the larger forms they were much sculptured and excavated for the accommodation of mucous canals. The large eyes were supported by a ring of sclerotic bones, found well developed at the present day only in the eyes of some birds. In the middle of the cranial roof between the two parietal bones was the conspicuous pineal foramen supposed to have lodged a functional median eye. The nostrils were situated near the tip of the snout and the internal nares in the anterior part of the palate. The base of the skull was imperfectly ossified, but there was a well-developed basi-occipital bone with usually two occipital condyles. This deficiency of bone was supplied by the large superficial parasphenoid. The lower jaw was complex and the occurrence of an infradentary bone is especially noteworthy. Teeth of a simple, conical, partly hollow form, or with the walls fluted or, as in the labyrinthodonts (q.v.), complexly folded, existed on the jaws and palate. The notochord generally persisted and the vertebræ consisted of mere bony shells or were better ossified and formed of alternating intercentra and pleurocentra supporting the hæmal and neural arches or were otherwise segmented. There was never more than a single sacral vertebra. Scapula, coracoid, clavicle and interclavicle, were always present in the shoulder girdle and traces of a sternum sometimes appear. Likewise an ischium, ilium and sometimes a pubis have been found on each side of the pelvis. Both fore and hind limbs were simple and salamander-like, the carpus and tarsus unossified in the smaller species and presenting all of the primitive elements with two or three centralia in *Archegosaurus* and other larger forms. Ribs were simple and never joined the sternum. Some forms like *Branchiosaurus* were covered with an armor of scales.

The stegocephali were the first vertebrates to leave the water and assume more or less completely terrestrial habits; they were the first whose limbs departed from the fin type and became pentadactyl; their nasal passages show that they breathed air and they probably had lungs; their teeth indicate a flesh diet, probably consisting chiefly of fish. Footprints of stegocephali are found in abundance in rocks representing the muddy shores of the Carboniferous Period and remains of these creatures are found from the Lower Carboniferous through the Permian and in the Triassic in Europe and America. They are especially abundant in the Permian of Texas from which many interesting forms have been taken. Palæontologists differ on the question of their origin, some considering them descendants of the crossopterygians, others of the Dipnoans. Whatever their origin the stegocephali formed the starting point for all terrestrial and air-breathing vertebrates, probably first giving rise to primitive reptiles like the cotylosauria, becoming themselves extinct.

Consult: Credner, 'Die Urvierfüssler'; Naturw. Wochenschrift, (Berlin 1891); Cope, 'American Naturalist' (1884); Woodward, 'Vertebrate Palæontology' (Cambridge 1898).

Stegosau'ria, a group of dinosaurs (q.v.).

Stein, stīn, **Charlotte von**, German writer, friend of Goethe (q.v.): b. Weimar 25 Dec. 1742; d. there 6 Jan. 1827. She was married in 1764 to the duke's master of the horse. Her friendship with Goethe was broken suddenly after his return from Italy (1788). Goethe's 'Letters' to her were first published in 1848–51, edited by Schott. A final collection was printed by the Goethe Society in 1886. She wrote a tragedy, 'Dido' (1867; ed. by Duntzer). Consult the 'Life' by Duntzer (1874).

Stein, Heinrich Friedrich Karl, German statesman: b. Nassau 26 Oct. 1757; d. Kappenberg, Westphalia, 29 June 1831. He studied at Göttingen, entered the mining department of the Prussian government, became head of the mines and manufactures (1784) department in Westphalia, visited the mining districts of England in 1786, became president of the provincial chambers of Westphalia in 1796, and a minister of state in 1804. For the severity of his criticisms on the administration he was dismissed (1807), but in a few months he was recalled, with power to introduce his reforms. Accordingly he abolished serfage by edict, made military service obligatory on all classes, and rearranged the financial and administrative affairs. By means of these reforms he laid the basis of Prussia's future greatness, but in less than a year he was proscribed by Napoleon and dismissed from office. He afterward visited Saint

Digitized by Google

Petersburg, and was instrumental in bringing about the coalition which crushed Napoleon. When the military struggle was over he spent his life in retirement. Consult: Pertz, 'Das Leben des Ministers Freiherrn von Stein' (1849); Stern, 'Stein und sein Zeitalter' (1855); Seeley, 'Life and Times of Stein' (1878); Meier, 'Die Reform der Verwaltungs-organisation unter Stein und Hardenberg' (1881); and the popular biographies by Neubauer (1894) and Bauer (1895).

Steiner, stī'nėr, **Bernard Christian,** American educator: b. Guilford, Conn., 13 Aug. 1867; was graduated from Yale in 1888; was a fellow in history at Johns Hopkins, 1890–1; instructor in history at Williams College, 1891–2; instructor of history at Johns Hopkins, 1893, and associate professor there since 1894. He was dean and professor of constitutional law, Baltimore University, 1897–1900, and has been dean and professor of public law in the Baltimore Law School since 1900. Since 1892 he has been librarian of the Enoch Pratt Free Library. His publications include 'Education in Connecticut' (1893); 'Citizenship and Suffrage in Maryland' (1895); 'Institutions and Civil Government of Maryland' (1899); etc.

Steinheil, stīn'hīl, **Karl August,** German physicist and astronomer; b. Rappoltsweiler, Alsace, 12 Oct. 1801; d. Munich 12 Sept. 1870. After completing a course in law at the University of Erlangen, and courses in astronomy at Göttingen and Königsberg, he was appointed to the chair of physics and mathematics in the University of Munich. He later entered the service of the Austrian government, becoming especially noted for his development and perfection of the telegraph system, a service which he also rendered to the Swiss government a few years later. In 1836 he built the first printing telegraph, invented an electro-magnetic telegraph, the electrical clock, a special pyroscope, and brought out the first daguerreotype picture in Germany. He also invented several optical instruments, and in 1854 began the manufacture of optical, astronomical, and photographic materials, and it was in his factory that the telescopes in the observatories of Upsala, Mannheim, Leipsic, etc., were made. Steinheilite or iolite, a transparent mineral, was named after him.

Steinheil, Louis Charles Auguste, Alsatian painter: b. Strasburg 26 June 1814; d. Paris 17 May 1885. He studied with Decaisne and painted in nearly every medium, but gave especial attention to glass painting and church decoration. In 1876 he was commissioned to execute frescoes in the cathedral of Strasburg. Among his works are 'St. Philomela' (1841); 'Mother' (1847), Nantes Museum.

Steinitz, stīn' its, **William,** German chess player: b. Prague, Bohemia, 14 May 1836; d. New York 12 Aug. 1900. He was educated at Prague and Vienna, and early became famous as a chess player, taking prizes at Vienna in 1859, 1860, and 1861. In 1862 he won sixth prize in an international match at London and in 1866 took the first prize in the tournament of the British Chess Association. In the international tournament of 1872 at London he won the world's championship and at the Vienna international tournament of 1873 he beat the world's record by winning 16 straight games. That year he settled in London, but in 1882 removed to the United States. During 1885–91 he edited the 'International Chess Magazine.' In 1890 he won the world's championship for a second time; but in 1894 and 1897 was defeated by Emmanuel Lasker. He published 'The Modern Chess Instructor' (1889).

Steinmetz, stīn'mĕts, **Karl Friedrich,** Prussian military officer: b. Eisenach 27 Dec. 1796; d. Landeck 4 Aug. 1877. He entered the army in 1812 and fought during the Napoleonic campaigns of 1813–15. In 1848 he commanded a regiment of the Royal Guards at Berlin and gained distinction in his encounters with the populace. The same year he fought in the Danish campaigns. In the Austrian war of 1866 he commanded the 5th army corps and defeated the Austrians in three successive engagements at Nachod, Skalitz and Schweinschaeld, 27–29 June. At the outbreak of the Franco-Prussian war he was appointed, in July 1870, to command of the right wing operating in the neighborhood of Metz against Bazaine, and fought at Spichern, Colombey-Nouilly, and Gravelotte. At this time friction arose with other officers and he asked to be relieved of his command, which was acceded in September 1870, and he was appointed governor-general of Posen and Silesia. The following year he was made field-marshal.

Steinway, stīn'wā (originally **Steinweg**), **Henry Engelhard,** American piano manufacturer: b. Wolfshagen, Germany, 15 Feb. 1797; d. New York 1871. He learned organ-building and piano-making and established a business at Seesen, near the Harz Mountains, but emigrated to the United States in 1849, and with his three sons was employed in various piano factories in New York. In 1853 he founded the firm of Steinway & Sons, and in 1855 exhibited a square piano in which the American iron frame was combined with an overstrung scale, the first example of the Steinway system. About 1866 the Steinways began to make upright pianos; their instruments exhibited at the Universal Exhibition of 1867 became models for Continental manufacturers, while later improvements have enabled the firm to take rank with the famous older makers of Europe.

Stel'la Mi'ra. See MIRA.

Stell'horn, Frederick William, American Lutheran theologian: b. Hanover, Germany, 2 Oct. 1841. He was graduated from Concordia College, Fort Wayne, Ind., in 1862, was ordained to the Lutheran ministry in 1865, and held two pastorates, 1865–9. He was a professor at Northwestern University, Wis., 1869–74; at Concordia College, 1874–81, and has been professor of theology and German at Capital University, Ohio, since 1881, and dean of the theolog-

Digitized by Google

ical seminary of the same institution since 1903. He has published 'Kurzgefasstes Wörterbuch zum Griechischen Neuen Testament' (1886); 'The Error of Modern Missouri' (1897); 'The Epistle of St. Paul to the Romans Briefly Explained' (1899).

Stelvio, stĕl'vē-ō, Austria, a lofty Alpine pass (9,042 feet), between the Tyrol and Lombardy, forming part of the great military road from Milan to Innsbruck, completed by the Austrian government in 1824. It is 33 miles long, and its bridges and causeways, and terraces cut in the rock are especially noteworthy. The pass is remarkable for its views and the grandeur of its scenery. It can only be utilized in the summer season.

Stem, the main axis of a plant. Stems usually bear foliar organs, such as leaves, but in the carrion-flower (*Stapelia*), and in some other plants, no leaves are produced; and in cacti the leaves are rarely observed because they are early deciduous. Though there are stem-like organs among the algæ and fungi (*Thallophytes*) and liverworts and mosses (*Bryophytes*), true stems are found only among the club-mosses, horsetails, and ferns (*Pteridophytes*) and the flowering plants (*Spermatophytes*). In the last named group the stems are produced by the development of the embryonic plumule, and reach their maximum size in the California redwood which becomes more than 350 feet tall and may exceed 20 feet in diameter.

Stems are very diverse in general habit; they may be erect and unbranched as in most palms; erect and branched as in pine and many other trees; scrambling as in blackberries and raspberries; twining as in morning-glory and hop; climbing as in grape and Boston ivy; creeping as in dewberry and periwinkle; and with many modifications of these general types. They are also definable according to duration as annual and perennial; and according to structure as herbaceous and woody. These are also modified in nature.

Botanists favor a classification which deals with the character of foliar organs borne, thus: (1) leaf-bearing stems, generally most evident since they bear leaves, are consequently aerial and frequently branched; (2) flower-bearing stems; and (3) scale-bearing stems, which bear rather small, more or less leaf-like but not green organs, and may be situated above or below the surface of the soil. The last group runs into many modifications, such as rhizomes, tubers, and bulbs below ground, and the buds of trees and shrubs above ground. They are also grouped according to their anatomical structure, as will be made evident below.

The functions of stems are usually to lift the leaves and flowers off the ground and expose them to light and air, or to act as storage-organs in which reserve food is placed until needed. While the epidermis remains green, aerial stems can, and do, perform the functions of leaves in assimilating food, a very important office in such plants as cacti. In function, the stems may be sharply contrasted with roots or descending axes; but none of these are constant, there being exceptions. Thus, most stems have chlorophyll (q.v.) which is almost never present in roots, except a few aerial ones; stems usually bear leaves, roots do not; the stem-tip is almost invariably a naked growing point, a root-tip is generally protected by a root-cap; stem-branches are superficial outgrowths (exogenous buds), root-branches develop endogenously from an internal layer; and usually stems and roots take opposite directions with respect to gravitation. In describing aerial stems the positions of leaves (nodes) are distinguished from parts which are leafless (internodes); the buds which appear in the axils of the leaves (axillary) from those which are terminal (apical) or which appear arbitrarily (adventitious); etc. The method of branching is also important in classification, as lateral, false dichotomous, dichotomous, etc.

The internal structure of a stem may be understood by examining twigs of a dicotyledonous tree such as oak. The bark peels off and leaves a white woody cylinder. At the place where bark and wood separate is a more or less mucilaginous layer of cells (cambium) which are readily ruptured. This layer is responsible for growth in girth, since its cells are actively dividing during the growing season, forming bark layers externally and wood layers internally. It is also from this layer that the healing of wounds in the stem is conducted. The formation of the «callus» in cuttings, and the union of grafts is also a function of this layer; hence its importance from the forester's and horticulturist's standpoint. When a ring of bark, which is usually found in three layers (outer, middle and inner), is removed but the wood is uninjured, the leaves will not wither; hence the conclusion that the water ascends through the wood. If the ring be through the young wood the leaves will wither; hence the deduction that the ascent of water is through the young wood. This conclusion is corroborated by the fact that trees will flourish after the heart-wood has decayed. The descent of food to the roots and to other places where it is needed for growth or for storage, is through the layers just outside the cambium (the inner bark). By means of the microscope and thin sections of stems a great variety of structures are revealed. Commencing with the growing-point there is found an external epidermis and an almost homogeneous internal structure of «fundamental tissue.» This latter becomes more and more differentiated in parts more remote from the tip. Firm strands (fibro-vascular bundles) are usually first observed arranged radially in dicotyledonous plants. They consist of an internal woody part (xylem) and an external bast part (phloem) and between each pair a persistent layer of cambium. Each bundle terminates in a leaf above, becomes connected with others lower down and terminates below in the little rootlets. In the internal structure of the stems of dicotyledonous trees they constitute the wood. Between them are plate-like structures extending, in cross section, like the spokes of a wheel from various points at, near, or remote from the centre to or toward the circumference. The fundamental tissue continues undifferentiated in the cambium, slightly modified in the pith if there be any pith, and in the medullary rays. In monocotyledonous plants the fibro-vascular bundles are scattered in the fundamental tissue, pursue a curved course (inward and outward) and are collateral. The cambium being consumed at an early period of growth accounts for the usually uniform or very slightly

Digitized by Google

tapering stems of plants belonging to this group — bamboos, grasses, etc.,— and also for the non-separation of the bark from the generally thin layer of wood which surrounds a mass of pith or a hollow space. The development of growth in these plants is not marked by annual rings as in the dicotyledons.

From an economic standpoint, stems are of wide importance. Various underground stems are used for food; for example, potato, sweet potato. Jerusalem artichoke, onion, asparagus, kohl-rabi, etc. Others are used as condiments such as ginger, licorice, cinnamon, sassafras, etc. Many furnish valuable fibres such as hemp, flax, jute, ramie, etc. Others are employed in tanning, as the barks of oak, chestnut, and hemlock. The pith of many, such as sago, are used for food. The juices of others furnish rubber, palm wine, pulque, arrack, and various oils. But the most important commercial uses made of stems are probably as timber and lumber, for which the dicotyledonous trees are most widely employed, as will be sufficiently clear from the above discussion.

Sten'ciling, a mode of decorating or marking with paint or ink, which may be adopted by those who are unskilled in the use of the brush. The design or mark is cut out in a sheet of pasteboard or a thin plate of metal called a stencil, which is applied to whatever is to be marked. The coloring matter is then laid freely over the stencil by means of a brush, and after the stencil is removed the design remains marked out on those parts of the surface which the coloring matter has reached through the spaces left in the stencil.

Stendal, stĕn'däl, Germany, a town in Prussia in the province of Saxony, on the Uchte, 35 miles northeast of Magdeburg. The cathedral, restored in 1893, contains archæological and natural history collections of the region. It has courts of justice, a Roland pillar, two ancient gateways, and a statue of Winckelmann, the art critic. There are textile industries and large railroad shops, starch-mills, brickyards, agricultural machine works, and other factories. Pop. about 25,000.

Stendhal, stän-däl. See Beyle, Marie Henri.

Sten'ness, or **Sten'nis,** Scotland, a loch in the Orkney Islands, a few miles northeast of Stromness, 14 miles in circumference. It is celebrated for two groups of prehistoric standing stones on its shores similar to those of Stonehenge. The large group, known as the Ring of Brogar, consists of 15 stones in an enclosure 340 feet in diameter. See Standing Stones.

Steno, stā'nō, **Nicholas,** Danish scientist: b. Copenhagen 1638; d. Schwerin, Germany, 25 Nov. 1687. He was educated in medicine, made study of the anatomy of the time, wandered about the continent, finally settled at Florence, was made physician to Grand Duke Ferdinand II., but subsequently turned to a churchly career, was made a Roman Catholic bishop, and went to northern Germany as vicar-apostolic. He was the first to explain the nature of fossil animals, and in writing of the structure of the crust of the earth clearly described the stratification of rocks, and differentiated them as of mechanical, chemical, and volcanic origin. Consult the article by Hughes in 'Nature' (1882).

Stenog'raphy. See Shorthand.

Stenotaph'rum. See Grasses in the United States.

Sten'tor, in Greek history, the name of a herald in the Trojan war, famous for the loudness of his voice, which was said to equal that of 50 other men together; hence, a person having a very loud strong voice.

Sten'tor. See Infusoria.

Step, Edward, English author: b. London 11 Nov. 1855. He was editor of 'Welcome' (1886–92); 'Boys' (1892–4); and 'Science Gossip' (1894–5). He has published 'Plant Life' (1880); 'By Seashore, Wood, and Moorland' (1891); 'By Vocal Woods and Waters' (1894); 'Romance of Wildflowers' (1899); 'Shell Life' (1901); etc.

Steph'anite («brittle silver ore»), an orthorhombic metallic mineral, of iron-black color and streak; hardness 2 to 2.5; specific gravity, 6.3; brittle and opaque. It is a silver sulphantimonite, containing 68.5 per cent of silver, and is an important ore of that metal in Austria, Germany, Mexico, Peru, Nevada, Idaho and elsewhere.

Stephanotis, a genus of tropical asclepiadaceous climbing plants. They are twining shrubs, often reaching great heights, with deep-green, coriaceous, opposite leaves. The flowers are large, five-merous, waxy and very fragrant, in axillary cymes. The corollas are funnel-shaped or salver-shaped, the limb being starlike, with overlapping lobes, and the tube long and cylindrical, but enlarged at the base and often again at the throat. *S. floribunda* is the evergreen greenhouse creeper, from Madagascar, famous for its waxen, fragrant flowers, appearing in spring and summer, and known by its generic name, or occasionally, as wax-flower or Madagascar jasmine.

Stephanus, stĕf'a-nŭs **(Estienne,** ā-tē-ĕn, **Etienne), Charles,** French scholar and printer: b. Paris 1504; d. there 1564. He abandoned the practice of medicine, in order to undertake the management of the Paris printing house which his brother Robert had abandoned on his retirement to Geneva. He was the author and printer of one of the first encyclopædias and gazetteers, 'Dictionnaire historique et poetique de toutes les nations, hommes, lieux, fleuves, etc.,' (1553); and of 'Prædium Rusticum' (1554).

Stephanus (Estienne, Etienne), Henry (nephew of the preceding), French scholar and printer: b. Paris 1528; d. Lyons March 1598. He was educated by the most accomplished scholars of his day and in 1551 accompanied his father to Geneva, where he acted as corrector of the press in his father's printing house. In 1554 he set up as an independent publisher and opened a new printing press with the assistance of Huldrich Fugger of Augsburg. He subsequently spent some years in Italy, in England and in the Spanish Netherlands. His monumental work 'Thesaurus Linguæ Græcæ' did not bring him the returns he had counted upon, principally through the rival enterprise of John Scapula, who had been his proofreader, and had treacherously published himself a more handy and cheaper edition of the work. His

Digitized by Google

troubles were increased by the death of his talented wife, Barbe de Wille (1581). Falling in commercial difficulties he became despondent, and was overtaken by sickness during a journey to Lyons, his reason became unsettled and he died in the hospital unattended by a friend. He was one of the most thorough Greek scholars of his time and his publications comprehended every relic of Greek literature then extant, and were distinguished by critical acumen, felicitous conjectural emendation, and exquisite typography. To him the scholars of Europe are indebted for 30 *editiones principes* of classical authors, publications which have remained in many cases the standard text, and the basis for subsequent recensions. He wrote also several important works in the French language, among which may be mentioned: 'Traité de la Conformité du Langue Français avec le Grec'; 'L'Introduction au Traité de la Conformité des Merveilles Anciennes avec les Modernes, ou Traité Préparatif a l'Apologie pour Hérodote' (1566). Consult Feugère, 'Essai sur la vie et les ouvrages de Henri Estienne' (1853).

Stephanus (Latinized form of **Estienne,** or **Etienne), Robert** (brother of Charles Stephanus (1504–64), French scholar and printer: b. Paris 1503; d. Geneva 7 Sept. 1559. He early devoted himself to a study of the ancient languages, Hebrew, Greek and Latin, and after the death of his father, Henry Stephanus the printer, he worked in the printing house with his stepfather Simon de Colines, but in 1529 opened an establishment of his own. Ten years later Francis I. appointed him "Printer Royal in the Ancient Languages," but the hostility of the divines of the day was roused by his publication of certain works, especially the Bible, and drove him to Geneva (1551), where he joined the Reformed Church. In his house even the servants spoke in Latin. His publications amounted to 382 in all, and included the Bible, Old and New Testaments in the original; the Greek and especially the Latin classics, with prefaces and notes; grammars and school books. Francis I. caused to be made for him the famous "royal type" (*characteres regii*). As an author he produced with the collaboration of Jean Thierry de Beauvais his valuable 'Thesaurus Linguæ Latinæ' (1531). Consult Crapelet, 'Robert Estienne, Imprimeur Royal' (1839).

Stephen, stē'vĕn, **Saint,** one of the first seven deacons of Apostolic times. He was stoned to death by fanatic Jews, probably in the August of 32 or 33 A.D. In the Acts of the Apostles (chapters 6 and 7) an account of his character, works and death is given in some detail. He did "great wonders and miracles among the people"; he was "full of faith and power." While dying he prayed for those who were stoning him; and is considered the protomartyr, the earliest Christian witness who died for his faith. In art he is represented in the vestments of a deacon; holding stones in his robe (the dalmatic) or in his hand; or with a stone in one hand, and a palm in the other; etc. He is celebrated in the Greek Church on 27 December; in the Roman Catholic and Anglican Church on the 26th of that month.

Stephen, the name of ten popes, as follows:

Stephen I., Saint. He succeeded Lucius I. in 253 and filled the papal chair till 257. He carried on a controversy with Cyprian of Carthage concerning the validity of the baptism of heretics, deciding in opposition to Cyprian that on being received into orthodoxy they must be rebaptized, which was not then the custom in Africa. He suffered martyrdom, and is honored as a saint, his day being 2 August.

Stephen II. He was chosen pope in March 752, but died four days later, before his enthronement and is sometimes erroneously omitted from the list of popes.

Stephen III. His pontificate lasted from 752 to 757. He sought the aid of Pepin the Short, against the Lombards who had overrun the exarchate of Ravenna. Pepin on defeating the Lombards gave the exarchate to the pope, which marks the beginning of the temporal power of the papacy.

Stephen IV.: d. 772. He succeeded Saint Paul I. in 768 and in a synod held in Rome in 769 sanctioned anew the veneration of relics and saints.

Stephen V. He succeeded Saint Leo IV. in 816, but his pontificate came to an end the next year. During his pontificate the council of Aix-la-Chapelle was held, by which provisions were made for the foundations of cloistral schools.

Stephen VI. He succeeded Hadrian III. in 885 and in a controversy with the emperor Charles the Fat, occasioned by his consecration having occurred before Charles had given his sanction to the election, came off victorious. Guido of Spoleto and Berengarius of Friuli having contended for the throne of Italy Stephen supported the former and crowned him. His pontificate ended in 891 when he was succeeded by Formosus.

Stephen VII. In 896 he succeeded Boniface VI., caused the body of Pope Formosus, the predecessor of Boniface VI., to be exhumed and thrown into the Tiber on account of his having belonged to the opposite political party. He also canceled all the ordinances and consecrations of Pope Formosus. The next year he was imprisoned by his opponents and murdered in prison.

Stephen VIII. He succeeded Leo VI. in the papal chair in 929 and was succeeded by John XI. in 931.

Stephen IX. He was a relative of Emperor Otto I. and his pontificate lasted from 939 to 943.

Stephen X. (1057–8). His rule lasted only from 1057 to 1058 but in that time the separation took place between the Roman and Greek Churches. His pontificate is also noteworthy on account of the commencement of a series of internal reforms in the church which were probably due to the influence of Hildebrand, afterward Gregory VII.

Stephen, king of England: b. Normandy 1105; d. 25 Oct. 1154. He was a son of Stephen, Count of Blois, by Adela, a daughter of William the Conqueror. His uncle Henry I. gave him the earldom of Mortaigne, in Normandy, and large estates in England, in return for which he took the oath for securing the succession to Henry's daughter, the Empress Ma-

Digitized by Google

tilda. Upon the death of Henry, however, he claimed the crown for himself (December 1135), and was crowned in London. His seat on the throne, by reason of the disaffection of many of the nobility, was very insecure, and in 1138 David of Scotland invaded England to secure the claims of his niece, but in the battle of the Standard was defeated by the northern barons (August 22). In the following year the empress herself landed in England with her half-brother, Robert, Earl of Gloucester, and a civil war ensued, in which Stephen was taken prisoner and Matilda acknowledged queen. Her conduct, however, excited an insurrection against her government; and, being shut up in Winchester Castle, she escaped with difficulty, while the Earl of Gloucester was taken prisoner. Stephen was exchanged for the earl, and the war was renewed. When Matilda retired to Normandy (about 1147) the contest was taken up by her son Henry. Finally the struggle was brought to an end in 1153 by the Treaty of Wallingford, in which it was agreed that Stephen should reign to his death, and that he should be succeeded by Henry.

Stephen, the name of several kings of Hungary from the 10th to the 13th century. Stephen I., Saint; d. 1038. He succeeded his father as duke in 997, and was crowned first King of Hungary in 1000. He reformed the manners of his subjects, enacted excellent laws and introduced Christianity into his kingdom. Stephen was canonized and became the patron saint of Hungary. STEPHEN II. succeeded his father Koloman in 1114. He invaded Poland and Austria, and marched into Russia, but was unsuccessful everywhere. He abdicated, retired to a monastery, and died in 1131. STEPHEN III.; d. 4 March 1173. He was crowned king in 1161, but was almost immediately deposed by the nobles. He regained the crown, however, in 1165, and reigned till his death. STEPHEN IV.; d. Semlin 1164. He ascended the throne in 1161. He was the uncle of Stephen III., by whom he was defeated in 1163, soon after which he died. STEPHEN V.; d. 1 Aug. 1272. He reigned two years only, 1270–2, but gained an illustrious name by his victories over Ottocar, king of Bohemia.

Stephen Bathori, king of Poland: b. Hungary 1522; d. Grodno, Poland, 12 Dec. 1586. He was the second of the kings elected by the nobles of Poland, having been declared sovereign in 1575 to succeed Henry of Valois, who had become king of France. The royal prerogative, having been curtailed still further than in Henry's time, extended only over a small district adjacent to the king's estate, but Stephen wrested Livonia from Russia. He was the organizer of the first Cossack regiments, and established the University of Wilna. See POLAND.

Stephen, SIR **Leslie**, English biographer and essayist: b. London 28 Nov. 1832; d. there 22 Feb. 1904. He was educated at Eton and Cambridge, and in 1883–4 was Clark lecturer on English literature at Cambridge. He edited 'The Cornhill Magazine' 1871–82, and in the last named year became editor of 'The Dictionary of National Biography,' which position he held for nine years, but continued to contribute to it till the work was completed, writing in all 378 biographies, an amount equal to three entire volumes and practically covering in the list the literary history of the 18th and 19th centuries. He was thoroughly conversant with the work of the theologians, philosophers, and economists of those centuries and the outcome of his knowledge is seen in such works as 'History of English Thought in the 18th Century' (1876); 'Freethinking and Plain Speaking' (1873); 'Lives of Johnson' (1878); 'Pope' (1880); and 'Swift' (1882); 'An Agnostic's Apology' (1893); and 'The English Utilitarians' (1900); a work of the utmost importance. Still other works by him are: 'The Playground of Europe' (1871), a record of Alpine experiences; 'Hours in a Library' (1874–79); 'Life of Sir James Fitzjames Stephen' (his brother) (1895); 'Social Rights and Duties' (1896); 'Studies of a Biographer' (1898); 'Thomas Hobbes' (1904). He was the warm friend of James Russell Lowell, visiting him more than once in this country, and was an appreciative admirer of the best in American literature and life. At the close of the Civil War he accomplished a great deal toward clearing away prejudice and misunderstandings between America and England in a pamphlet which contained a strong arraignment of the course of the London *Times* during the four years of war. His first wife, the youngest daughter of Thackeray, died in 1875. Stephen's religious attitude was that of the agnostic, but he was not aggressive. His greatest service to his time was in the 'Dictionary of National Biography.' For this work he was an ideal editor, his judgment determining not only the selection of subjects but the choice of writers, and he so carefully held them to their task that the work went regularly forward at the rate of four volumes a year. He was knighted in 1902.

Stephens, stē'vĕnz, **Alexander Hamilton**, American statesman: b. near Crawfordville, Ga., 11 Feb. 1812; d. Atlanta, Ga., 4 March 1883. He was prepared for college by a Presbyterian clergyman, and in 1828 entered Franklin College (now the University of Georgia), a Presbyterian educational society defraying his expenses with a view to his becoming a minister. In 1832 he was graduated with first honor, and for two years taught school to pay for his education. In 1834, after two months' study, he passed a brilliant examination and was admitted to the bar. He was one of the leaders in organizing the Whig party in Georgia; was a member of the legislature in 1836–42; in 1839 a delegate to the Charleston Commercial Convention, and in 1843 was elected to Congress on a "general ticket." In 1838–9 he advocated the annexation of Texas by joint resolution of Congress; in 1844 he opposed Tyler's treaty of annexation; and in 1845 drew up the measure that secured the annexation. Though opposing Polk's policy in the Mexican War, he considered the results of the war fortunate for the South. In 1850 he opposed the strong "Southern Rights" movement that threatened to result in secession. Influential in bringing about the Compromise of 1850 (q.v.), he considered that measure a repeal of the Missouri Compromise (q.v.). He drafted the celebrated "Georgia Platform" of 1850 in which the Constitutional Convention stated that, while not entirely satisfied by the Compromise of 1850,

Digitized by Google

Georgia was anxious to remain in the Union, though further encroachment upon her rights would result in disruption. In 1852 Stephens, with other prominent Southern Whigs, refused to support Scott, the Whig nominee for President, who did not approve of the Compromise of 1850 as a final settlement of the questions involved. This stand disrupted the Whig party in the South. Both Stephens and Toombs voted for Daniel Webster after he was dead. Holding the same territorial doctrines as Douglas, Stephens pushed through the House (1854) the Kansas-Nebraska bill (q.v.). After 1854 he acted with the Democrats, opposing the formation of the Know-Nothing party out of the wreck of the Whig organization. (See AMERICAN PARTY.) Stephens supported the policy of the Buchanan administration, though he disliked Buchanan; and in 1859, foreseeing a conflict over the slavery question, retired from Congress. In 1860 he opposed secession, and was on the Douglas electoral ticket. In the Georgia Convention, 1861, he opposed the policy of secession, though asserting the right of the State to secede. When his State seceded he acquiesced, was elected to the Confederate Provisional Congress, chosen Vice-President of the provisional government, and was sent to arrange a treaty with Virginia. In 1862 he was elected Vice-President under the permanent constitution of the Confederate States. Unable to reconcile his theories of government with conditions of war, he was often at variance with President Davis on questions of State rights. The elements of opposition to the administration gathered around him, but he had little influence during the war. In 1864 Stephens, Toombs, and Joseph E. Brown were the leaders of the Georgia Peace Party, believing that the Richmond government could make peace if Davis desired. In February 1865 Stephens was at the head of the unsuccessful Confederate Peace Commission which met President Lincoln at Hampton Roads. (See HAMPTON ROADS CONFERENCE.) Before the war ended he left Richmond and returned to his home, whence arose the report that he had deserted the Confederacy. In April 1865 he was arrested, and was confined in Fort Warren, Boston harbor, until October, when he was paroled. Stephens favored Johnson's plan of restoration, saying that since the South had failed to preserve the Constitution out of the Union, it should again try to save it in the Union. Elected in 1866 to the United States Senate and refused a seat, he turned his attention to writing a history of the sectional controversy. In 1868 he was elected professor of history and political science in the University of Georgia, but declined because of ill health. In 1871, being in reduced circumstances, he taught a law class; in the same year was editor of the Atlanta *Sun*, which opposed the election of Greeley; and in 1871 he was defeated for the United States Senate by the carpet-bag element. From 1874 to 1882 Stephens was in the lower house of Congress, resigning to become governor of Georgia. In Congress he opposed the Civil Rights Bill of 1875, which aimed to give the negro certain social rights in the Southern States, and also opposed the methods of the Electoral Commission in 1876, and wanted the fraudulent returns rejected; but when Hayes was declared elected Stephens advised acquiescence. In 1882 he was elected governor of Georgia by a majority of 60,000 over his opponent, a Confederate soldier, and made an excellent governor, but died before the end of his term. In personal appearance, Stephens was small and thin, never weighing over 90 pounds. His health was always bad, but his disposition cheerful. Children and negroes especially were fond of him, and to the latter he was always a trusted friend. He never blamed them for the excesses of the carpet-bag governments. He believed in the fundamental and natural inequality of the races; and Southern society and government are still based on the principle of his Savannah speech of 1861, in which he declared that the Confederacy was based on that inequality. He was a logical and effective speaker, without the arts of the popular orator. Whig or Democrat, his political theories were the same. He was a Democrat of the school of Jefferson, believing in State rights, State sovereignty, strong local government, and the largest liberty of the individual compatible with good government. He published 'A Constitutional View of the War between the States' (1867–70); 'A School History of the United States' (1871); and 'A Compendium of the History of the United States' (1883). Consult: Johnston and Browne, 'Life of A. H. Stephens' (1878); Cleveland, 'A. H. Stephens in Public and Private Life, with Letters and Speeches' (1866); Trent, 'Southern Statesmen of the Old Regime' (1897). WALTER L. FLEMING,
Professor of History, West Virginia University.

Stephens, Ann Sophia Winterbotham, American novelist: b. Derby, Conn., 1813; d. Newport, R. I., 20 Aug. 1886. She was married to Edward Stephens in 1831, was editor of 'The Portland Magazine,' 1835–7, and during 1836 prepared the Portland Sketch-book. She published 'Fashion and Famine' which was widely popular (1854); 'The Old Homestead' (1855); 'Silent Struggles' (1865); 'Mabel's Mistake' (1868); 'Phemie's Experience' (1874).

Stephens, Henry Morse, American historian: b. Edinburgh, Scotland, 3 Oct. 1857. He was educated at Haileybury College, and Balliol College, Oxford, and was engaged in journalism 1880–92. After being lecturer on Indian history at Cambridge University 1892–4, he was called to the chair of modern European and English history at Cornell University in 1892, which he held till 1902. Since the date last named he has been professor of history at the University of California. He is the author of a much valued 'History of the French Revolution' (1886–92); and of 'The Story of Portugal' (1891); 'Albuquerque' (1892); 'Revolutionary Europe 1789–1815' (1893); 'Syllabus of a Course of Lectures on Modern European History 1600–1890' (1899).

Stephens, James, Irish revolutionist: b. Kilkenny 1824; d. Dublin 29 March 1901. At 21 he went to Dublin and joined the young Ireland party. He was wounded at the fight at Ballingarry, 29 June 1848. In the next 12 years he became prominently known as a Fenian, and as such exercised an enormous and despotic influence, and throughout showed remarkable dexterity in the disguises and characters he assumed on his visits to all parts of Ireland. In 1863 he founded the 'Irish People,' published in Dublin. He visited the United States early in 1864 to

Digitized by Google

attempt to overthrow the rival schemes formed there by patriots, and was arrested in Dublin on 10 November of the same year, 14 days later making his escape from Richmond Bridewell. He found his way to New York, where, in 1867, he was formally deposed by the Fenians, and fled to Paris. He was allowed to return to Ireland in 1891.

Stephens, John Lloyd, American author: b. Shrewsbury, N. J., 28 Nov. 1805; d. New York 10 Oct. 1852. He was graduated in 1822 at Columbia College; studied law, and practised for eight years at the bar in New York. He made an extended journey through Europe and the East, an account of which he published in fuller narrative form under the title 'Incidents of Travel in Egypt, Arabia, Petræa, and the Holy Land' (1837); and 'Incidents of Travel in Greece, Turkey, Russia, and Poland' (1838). In 1839 he was sent by the United States government to negotiate a treaty with the government of Central America; and as the result of his experiences and investigations in that country published 'Incidents of Travel in Central America, Chiapas, and Yucatan' (1841); and after further exploration 'Incidents of Travel in Yucatan' (1843). He was one of the organizers of the first Atlantic steam navigation company and one of the first presidents of the company which constructed a railway across the Isthmus of Panama, and superintended the construction.

Stephens, Lon V., American financier: b. Boonville, Mo., 21 Dec. 1858. He was graduated at Washington and Lee University; entered the Central National bank at Boonville and served in every position from messenger to president. He was elected State treasurer in 1890 and in 1897 became governor of Missouri.

Stephens, Robert Neilson, American novelist: b. New Bloomfield, Pa., 22 July 1867. He was educated at his father's academy, and after leaving school was engaged in various occupations. In 1886 he became dramatic editor of the Philadelphia *Press* and in 1893 became a theatrical agent and dramatist in New York. He wrote 'An Enemy to the King,' which was produced by E. H. Sothern in 1896, and 'The Ragged Regiment,' produced in 1898. He has published 'An Enemy to the King' (1897); 'The Continental Dragoon' (1898); 'A Gentleman Player' (1899); 'Captain Ravenshaw' (1901); 'Mystery of Murray Davenport' (1903).

Stephens, Uriah Smith, American labor reformer: b. near Cape May, N. J., 3 Aug. 1821; d. in Europe 13 Feb. 1882. He was educated for the Baptist ministry, but became a tailor, which calling he followed until his death. He was a lover of books and a close student of economic affairs, and sought through speeches and letters to the press to reform labor conditions in the United States and to further the cause of Abolition. In 1869 he founded the Knights of Labor and ever afterward devoted himself to the upbuilding of that order. He became the first Grand Master Workman of its General Assembly in 1878.

Stephens, William, American colonial governor: b. Boscombe, Isle of Wight, 28 Jan. 1671; d. Georgia August 1753. He was graduated from Cambridge in 1688, and before coming to America represented the Isle of Wight in Parliament. In 1736 he made the acquaintance of James Oglethorpe in South Carolina, and in the following year went to Georgia, where he was successful as a planter, and rose to prominence in the new community. In 1743 he was made president of the county of Savannah, and later governor of the entire colony. His administration lasted until 1750, when he resigned. He wrote 'A Journal of the Proceedings of Georgia from October 20, 1737,' a valuable historical work, but few complete copies of which remain. 'The Castle-builder, or the History of William Stephens of the Isle of Wight' (2d ed. 1759) is a biography by his son.

Stephens, William Richard Wood, English Anglican clergyman and author: b. Gloucestershire 5 Oct. 1839; d. Winchester 22 Dec. 1902. He was educated at Oxford, took orders in the Established Church, was vicar of Mid-Lavant, Sussex, 1870–3, rector of Woolbeding, Sussex, 1876–94, and dean of Winchester from the latter date. He published 'Saint Chrysostom: his Life and Times' (1872); 'Christianity and Islam' (1877); 'Hildebrand: his Life and Times' (1888); 'Life and Letters of Edward Augustus Freeman,' a work of much value (1895); 'The English Church from the Norman Conquest to Edward I.' (1901).

Stephenson, stē'vĕn-sŏn, **George,** English inventor: b. Wylam, near Newcastle, 9 June 1781; d. near Chesterfield 12 Aug. 1848. He was successively assistant fireman, fireman, and brakesman in a colliery, in 1802 was made engineman at Willington Ballast Hill, in 1808 took with two others the contract to operate the engines at Killingworth pit, and in 1812 was appointed engine-wright there. The application of steam-power to locomotive engines had for some time engaged the attention of scientific men. Stephenson eagerly devoted himself to the working out of the idea, and having established an extended reputation for soundness of judgment and engineering skill he was supplied by Lord Ravensworth with the means of constructing a locomotive engine, which was placed, 25 July 1814, on the colliery tramway, and drew eight loaded wagons at the rate of four miles an hour. Though thus partially successful, Stephenson saw that more was needed to make this mode of conveyance advantageous, and he accordingly invented the «steam blast,» which enabled him to double his rate of speed, and in 1815 he took out a patent for, and constructed an engine, which up to the present day (under certain modifications and improvements) has, like Watt's steam-engine, continued as a model in the construction of locomotives. In this same year he devised a safety-lamp, the Geordie, for miners, which was produced prior to and altogether independent of the better known invention of Sir Humphry Davy, and is still employed in preference to the latter in some parts of Northumberland. The following year he took out a patent for an improved form of rail and chair. In 1819 he was employed to construct a railway for the proprietors of the Hetton colliery, and in 1822 the Stockton and Darlington line for Pease, its leading promoter, who appointed him resident engineer, with an annual salary of £300. The line was opened 27 Sept. 1825, the engine being driven by Stephenson himself, and drawing 38 carriages, with a

Digitized by Google

total weight of about 90 tons, at a rate of from 12 to 16 miles an hour. This was the first steam railway in Great Britain on which passengers were conveyed as well as goods. At this period a copartnership was formed between Pease and Stephenson for the establishment of a locomotive manufactory at Newcastle, which was long the only work of the kind in the kingdom, and rapidly increased in extent and importance. The scheme of constructing a railway between Liverpool and Manchester had been set on foot in 1824, but the opposition to it, both in and out of Parliament, was so strong that it had to be temporarily abandoned. The bill was passed, however, on a second application, and the work commenced in 1826. After overcoming many difficulties, one of the greatest being the carrying of the line over Chatmoss, the railway was opened on 15 Sept. 1830. The results of the undertaking were most triumphant for Stephenson, and it proved the commencement of the British system of railroad transit. For ten years subsequent to this there was scarcely a line of railway opened in Great Britain with the construction of which Stephenson was not concerned. In 1840 he resigned most of his appointments, and settled at Tapton, in Derbyshire, where he took in hand the working of the Clay Cross Collieries, leaving the extension of the railway system to be carried out by his son Robert (q.v.). He still, however, remained connected either as engineer or otherwise with several lines, made professional journeys to Spain and Belgium, and was created a knight of the latter country by King Leopold. He also took a considerable interest in mechanics' institutes, and was the founder and president of the Institution of Mechanical Engineers at Birmingham. George Stephenson may be regarded as an embodiment of the sturdy and energetic spirit which has raised the British nation to its high position industrially among the other countries of the world, and enabled it to effect such triumphs in enterprise. The standard authority is the 'Life' by Smiles as revised by that author for Vol. III. of his 'Lives of the Engineers' (1862).

Stephenson, Robert, English civil engineer: b. Willington Quay, near Newcastle, 16 Oct. 1803; d. London 12 Oct. 1859. He was son of George Stephenson (q.v.). In 1822 he studied at Edinburgh University. The elder Stephenson having shortly after this engaged in the locomotive manufactory at Newcastle in conjunction with Pease, Robert became his apprentice in 1823, but his health giving way after two years, he accepted an engagement to examine the South American mines, returning to England in 1827 by way of the United States and Canada. Not long after his return he assisted his father and Henry Booth in the construction of the locomotive (the Rocket) which gained the prize of £500 offered by the directors of the Liverpool and Manchester Railway for the best railway engine. The next great work on which he was engaged was the construction of the London and Birmingham Railway, the first railway into London, of which he was appointed engineer. The first sod of the line was cut at Chalk Farm in June, 1834, and the railway opened to the public in September, 1838. Much of his attention was given to the superintendence of the manufactory at Newcastle, and he made frequent professional journeys abroad, laying out lines of railway in Switzerland, Germany, and other parts of the Continent, and likewise in Canada, Egypt, and India. One of the most brilliant proofs of his engineering skill is displayed in the system of railway bridges and viaducts constructed under his directions. Among these may be mentioned more especially the high-level bridge at Newcastle, the Victoria Bridge at Berwick, the tubular bridges, of which he was the inventor, as exemplified in those over the Conway and the Nile, and the still more wondrous erections of the Britannia Bridge over the Menai Straits, and the Victoria Bridge over the Saint Lawrence. He introduced the tubular girder system in the building of wrought iron bridges. He took a considerable interest in public affairs, and from 1847 represented the borough of Whitby in Parliament. Consult Smiles' 'Lives of the Engineers,' Vol. III. (1862).

Stephenson's Depot (Carter's Farm), Engagement at. On 19 July 1864 Gen. Averell with 1,000 cavalry, 1,350 infantry, and two batteries, marched up the Valley pike from Martinsburg, W. Va., drove the Confederate cavalry from Darkesville toward Winchester, and halted near Stephenson's Depot, about six miles from Winchester. This placed him in rear of Early, who was at Berryville, who immediately retreated toward Strasburg, first sending Ramseur's division of infantry and two batteries to Winchester to support the cavalry brigades of Jackson and Vaughan, and check Averell's advance. On the morning of the 20th Averell, who had received a reinforcement of 300 cavalry, raising his force to about 2,800, resumed his march toward Winchester, in line of battle to resist a sudden attack or to make one. A regiment of infantry was deployed on either side of the road, with skirmishers in advance, another regiment marched on each side in column in rear of the right and left flanks, artillery in the centre, on the road, and a regiment of cavalry on each flank. Three miles north of Winchester, on Carter's Farm, Ramseur was encountered, moving with intent to capture Averell, whose force had been reported as a regiment of cavalry and one of infantry. Ramseur opened fire with four guns, and demonstrated with his cavalry on both flanks, under cover of which he formed line, Johnson's brigade on his right, Hoke's on the left, with Pegram's in reserve. Averell deployed his entire command in one line, withdrew his skirmishers, opened fire from his 12 guns, and, without pausing, sent in all his cavalry and infantry, drove in the Confederate cavalry, broke Ramseur's left, held by Hoke, which fled in disorder, followed by the remainder of the division to near Winchester, where Averell's immediate pursuit was checked by Jackson's cavalry. Averell captured four guns and about 280 wounded and unwounded prisoners, among them Gens. Lewis and Lilly, wounded. Ramseur had 73 killed and 130 wounded. Averell had 53 killed, 155 wounded, and 6 missing. Informed that a large force was gathering in his front, Averell established a strong picket-line and fell back two miles. On the morning of the 21st he entered Winchester unopposed, the Confederates having

Digitized by Google

GEORGE STEPHENSON.

FIRST TO APPLY THE LOCOMOTIVE STEAM ENGINE TO RAILWAYS FOR PASSENGER TRAFFIC.

Digitized by Google

retreated toward Strasburg. On the 22d he was joined by Crook, and next day both fought the battle of Kernstown (q.v.).

E. A. CARMAN.

Stepniak, stĕp'nyäk, **Sergius** (real name SERGIUS MICHAELOVITCH KRAVCHINSKI), Russian revolutionist and author: b. southern Russia 1852; d. London 23 Dec. 1895. After a liberal education, he identified himself with the revolutionary movement, was arrested in 1874, but released, and in 1880, on account of his advocacy of the "terrorist" policy, was compelled to leave the country. He went to Switzerland, and later to England, became identified with the Socialists there and with the Social Democrats of the Continent, and wrote and lectured (also in the United States) on the liberalization of Russia. Among his books on conditions and methods were 'Underground Russia' (1882) and 'King Stork and King Log' (1896). His views altered from violent to constitutional means in securing popular freedom.

Steppes, stĕps, Russia, a Tartar term employed geographically to denote those extensive tracts of land which, beginning at the Dnieper, extend along the southeast of Russia, round the Caspian and Aral Seas, between the Ural and Altai Mountains, and occupy a considerable portion of Siberia. These steppes present wide, treeless, monotonous tracts, which are covered with rough grass and shrubs during the short spring season, but soon become arid deserts owing to the drought of summer, and in winter are wastes of snow. Though they are all open, flat, and treeless, they differ considerably in aspect according to the nature of the soil of which they are composed; some tracts consisting of deep, black earth, clothed with shrubs and grasses; others of hard, sandy clay, and sterile; and others again of sand or rocky shingle, and only here and there dotted with vegetation. This applies, however, only to the spring and early summer; for during the summer droughts all are alike desert save round the springs and streamlets, and during winter, which comes on in October, the whole is one exposed and inhospitable snow-waste. The Siberian plain, as might be expected from its extent, is of a more varied character, consisting of low-lying tundras, or black, swampy peat mosses, of broad undulating steppes and partially wooded uplands; but the tundras and wooded lands are scarcely included in the steppes proper. From June till the middle of August the tundras are thawed to a small depth, the steppes are scantily covered with grass and mosses, the banks of the great rivers are green with the birch and pine, and immense herds of horses and cattle give animation to the scene. In winter fearful storms rage, and the dry snow is driven by the gale with a violence which neither man nor animals can resist.

Ster'coranism, in church history of the 9th century, an opinion taught by Amalarius, a priest of Metz and attributed also to Rabanus Maurus, archbishop of Mentz, that the eucharistic body of Christ nourishes not only the soul but the body also, which by it is prepared for the immortal life; and that, like all other nourishment, it is subject to the consequences of digestion.

Sterculiaceæ, stėr-kū-lĭ-ā'sę-ē, an order of dicotyledonous plants closely allied to the *Malvaceæ*, from which they are distinguished by the two-celled anthers. There are about 30 genera and 150 species, which comprise tropical and sub-tropical herbs, shrubs, and trees with alternate, entire, lobed or digitately compound leaves and generally axillary flowers which are often large and beautiful. They are also characterized by their mucilaginous qualities. Many are of economic importance, being used for food and for various other purposes. One of the best known species cultivated in the United States is the Chinese parasol tree, or Japanese varnish tree (*Sterculia plantanifolia*), which is very popular in the southern States upon lawns and is often found wild. In California the brachychitons (*S. diversifolia* and *S. acerifolia*) are popularly planted upon lawns and in streets for their shade and showy flowers, which in the former species are yellowish-white or greenish-red, and in the latter brilliant scarlet, hence a popular name "flame-tree." Both are natives of Australia.

Stère, stăr, the French unit for solid measure, equal to a cubic metre, or 35.3156 cubic feet. See WEIGHTS AND MEASURES.

Stereo-Chemistry (Greek, *stereos*, "solid"). In the development of the science of chemistry, it was discovered that two or more compounds may have the same empirical formulæ, and yet differ from one another in chemical and physical properties to a marked degree. Resorcin, pyrocatechin and hydroquinone, for example, all have the empirical formula $C_6H_4(OH)_2$, and yet they are distinctly different substances. Most cases of this kind are explainable by supposing that the constituent atoms are linked together in different ways in the several compounds; the compounds themselves being called "isomers," and the phenomenon "isomerism." (See ISOMERISM; AROMATIC COMPOUNDS; FATTY COMPOUNDS.) The arrangement of the atoms in such compounds has been investigated in many of these cases, and "constitutional formulæ" have been devised for the purpose of representing the internal structures of their molecules. Compounds have been found to exist, however, which apparently have the same constitutional formulæ, and which resemble one another very closely indeed in most respects, but which nevertheless exhibit some slight differences in physical and chemical properties, so that they cannot be regarded as absolutely identical. It is the province of stereo-chemistry to investigate such bodies, and to show how it is possible to reconcile their exceedingly close similarity with the existence of recognizable differences in certain respects. Isomerism of the kind here contemplated is commonly called "optical isomerism," from the fact that the bodies that manifest it differ mainly with respect to their action upon polarized light. It has long been known that certain crystals possess the power of rotating the plane of polarization of the light that they transmit. It is also known that the crystals of a substance that affects light in this manner may often be obtained in two slightly different forms, which possess symmetry of the same kind, and whose corresponding angles are equal, but which differ in the same manner as a man's right hand differs from his left one; or, more specif-

Digitized by Google

ically, as the image of an object as seen in a mirror differs from the object itself. A pair of crystals that differ only in this respect are said to be "enantiomorphous," and if one of them rotates the plane of polarization to the right, the other, when similarly placed, will rotate it to the left; the angle of rotation being the same in each case, if the crystals are of equal thickness. If two such enantiomorphous crystals of the same substance are melted or dissolved, the respective fluids that are obtained from them are commonly found to be identical with each other in all respects, so that if they affect the plane of polarization at all, they rotate it in the same direction, and by the same amount. It is plain that in cases of this sort the differences between the original crystals are of a purely physical nature, depending only upon the way in which the molecules of the substance are grouped, and not at all upon the internal structure of those molecules. In other words, two enantiomorphous crystals are to be regarded as composed of identically the same chemical substance, if they differ only in their optical properties, and become identical in all respects upon being melted or dissolved. Stereo-chemistry has nothing to do with substances of this sort, which are not to be regarded as isomeric in any sense. Stereo-chemistry deals

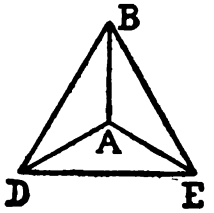


FIG. 1.

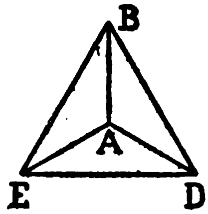


FIG. 2.

entirely with substances whose optical differences are manifested in the liquid state, and hence are to be attributed to internal differences in the molecules, rather than to mere differences in the grouping of the molecules among themselves.

As a simple example of optical isomerism, the case of lactic acid and its isomers may be cited. Lactic acid (which occurs in sour milk, and which may be extracted in the form of a syrupy liquid) has no effect upon polarized light; but sarcolactic acid (which occurs in the juice of flesh) rotates the plane of polarization to the right, and yet its chemical properties are practically identical with those of common lactic acid. A third acid, known as "lævo-rotatory lactic acid," has recently been prepared, which is almost indistinguishable from the two foregoing substances so far as its chemical properties are concerned, but which rotates the plane of polarization to the left. The chemical properties of all three agree with the constitutional formula $CH_3.CH(OH).COOH$; and yet they cannot be regarded as chemically identical. When polarized light is passed through equal thicknesses of equally concentrated solutions of sarcolactic and lævo-rotatory lactic acids, the plane of polarization is rotated in opposite directions, but by the same amount; and when equal quantities of sarcolactic and lævo-rotatory lactic acids are mixed, the mixture has no effect upon the plane of polarization, and (in fact) the mixture cannot be distinguished from ordinary lactic acid in any way. These general characteristics are manifested by all of the simpler optical isomers. They occur in pairs (or "twins"), one member of which rotates the plane of polarization to the right, while the other rotates it equally to the left. A third isomer also exists, which is composed of equal parts of the two optically active ones, and which is therefore itself inactive. The inactive member of the group is often called the "racemic" modification, the name being derived

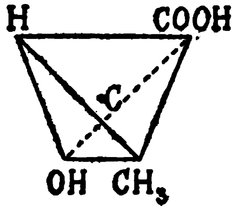


FIG. 3.

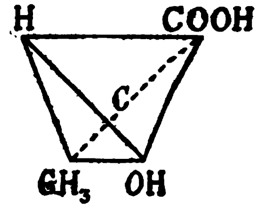


FIG. 4.

from racemic acid, which is an optically inactive mixture of dextro-rotatory and lævo-rotatory tartaric acids. (This statement, it is to be observed, applies only to the simpler cases of optical isomerism. For a more general statement, applicable in all cases, see below.)

In 1874 Le Bel and van't Hoff, simultaneously and independently, pointed out that all known compounds which manifest optical isomerism contain at least one "asymmetrical" (or unsymmetrical) central atom. In most of the known cases, this central, asymmetrical atom is a carbon atom; but a few cases are now known in which it is nitrogen. The chemistry of asymmetrical nitrogen compounds is still in its infancy, however, and hence in the present article attention will be confined solely to the asymmetrical carbon atoms; and we shall first treat of compounds in which only one such atom is present.

Carbon is a tetravalent substance, having four valencies (or bonds); and it has been well established (especially by the exhaustive researches of L. Henry) that these four valencies of carbon are all alike, so that if one atom of hydrogen in methane (CH_4), for example, be replaced by one atom of any other monovalent

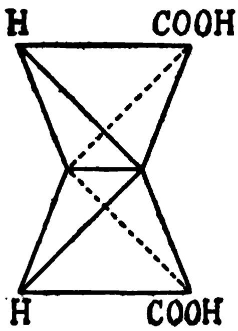


FIG. 5.— Maleic Acid.

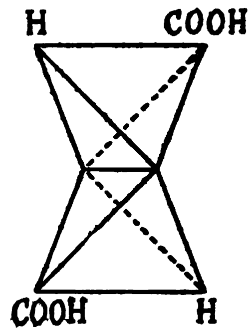


FIG. 6.— Fumaric Acid.

substance, such as chlorine, the resulting compound is precisely the same, whichever of the hydrogen atoms is so replaced. The fundamental discovery of Le Bel and van't Hoff was that the simplest class of the substances which ex-

Digitized by Google

hibit optical isomerism may be regarded as derived from methane, by substituting, for at least three of the hydrogen atoms that it contains, an equal number of monovalent atoms or radicals, no two of which are alike; so that the resulting compound consists of a central nucleus of carbon, each of whose valencies is satisfied by a different atom or radical. A carbon atom whose valencies are satisfied in this way is called an "asymmetrical" carbon atom. In the case of the various lactic acids which have already been cited, one of the fundamental hydrogen atoms of the methane remains undisturbed, while the other three are respectively replaced by OH, CH_3, and COOH. The structural formula of any one of these acids

may therefore be written
$$\begin{array}{c} CH_3 \\ | \\ OH - C - COOH. \\ | \\ H \end{array}$$

The central carbon atom is here the "asymmetric" atom, since its four bonds are satisfied by four unlike univalent radicals or atoms. From the admitted equality and similarity of the four carbon bonds, it appears to be inadmissible to suppose that the nature of the compound that is represented above can depend (for example) upon whether the COOH group is opposite the OH group, or adjacent to it. Le Bel and van't Hoff, however, suggested that we should think of the four carbon bonds, not as four lines radiating out from the carbon atom in some one plane, but as lines radiating out from the carbon atoms in space, in four symmetrically related directions. The carbon atom being represented by a given point in space, for example, we are to think of the four bonds that it has as corresponding to the four vertices of an equilateral tetrahedron, having the carbon atom at its centre. For the sake of further illustration, let us suppose that we are looking down upon one of the vertices of such an equilateral tetrahedron, as suggested in Figs. 1 and 2; and let us represent the four dissimilar radicals (or atoms) by which the four bonds of the carbon are satisfied, by the letters A, B, D, and E. We may suppose that in one of the optically active isomers these four radicals are disposed as in Fig. 1, and in the other as represented in Fig. 2. It is evident that two substances having such similar constitutions would be chemically so similar that it would be difficult to distinguish them by any ordinary test; and yet it is evident that they are not identical, since it will be found to be impossible to superpose either of these tetrahedra upon the other one, in such a way as to bring into coincidence all the vertices that carry similar radicals (or atoms). In fact, these two tetrahedra resemble each other enantiomorphically, just as the image of an object in a mirror resembles the object itself; and superposition is therefore impossible. The constitution of sarcolactic acid, according to this general scheme, might be represented as in Fig. 3, while that of lævo-rotatory lactic acid is represented as in Fig. 4. The central dot by which we have here represented the asymmetric carbon atom in each of these compounds is usually omitted from diagrams of this sort, the presence of this atom being sufficiently represented by the tetrahedron itself.

The name "stereo-chemistry" has reference to the use of a solid diagram for representing the constitutions of the compounds with which it is concerned; and the ideas which have been presented above are capable of being expanded into a general theory of the constitution of carbon compounds. The first successful attempt at the formulation of a theory of this sort was made by van't Hoff, in 1878. In this theory (which includes the explanation of isomerism of all kinds by the geometric relations of the solid diagrams that are used, and which is therefore often called the theory of "geometrical isomerism"), each carbon atom in a given compound is supposed to be represented by a separate tetrahedron; though in the practical applications of the theory it is customary to omit all the tetrahedra except those that relate to the central carbon atom, or to those which are of special or fundamental importance. When two carbon atoms are united by a single bond, their corresponding tetrahedra are supposed to be united in such a way that they are symmetrically situated, with one vertex in common; when they are united by two bonds, they are supposed to be symmetrically situated, with one edge in common; and when they are united by three bonds, they are supposed to have one entire face in common. In the case of the triple bond, the theory has no special interest; for in this case theory does not see any possibility of isomerism, nor has experiment revealed any case in which such isomerism exists. The use of a solid diagram for illustrating the isomerism of compounds containing two carbon atoms united by a double bond will be understood from Figs. 5 and 6, which correspond, respectively, to maleic and fumaric acids. (See FUMARIC AND MALEIC ACIDS.) There is no optical isomerism in the case of these compounds; this circumstance being explained, according to the theory of geometrical isomerism, by the fact that the points of attachment of the hydrogen atoms and the COOH groups are in each case all in the same plane. Moreover there is no asymmetric carbon atom in either case, because if the tetrahedra were separated, they could be turned so as to be perfectly superposable. The relative distances between the points of attachment of corresponding radicals (or atoms) is not the same in Fig. 5 as in Fig. 6, and hence it is to be expected that the isomers that these diagrams represent will behave differently with respect to solubility, melting point, boiling point, and in other respects also, including the facility with which they will react with other substances. It may be noted, in passing, that the atoms and radicals shown in Figs. 5 and 6 admit of still another arrangement, in which both of the hydrogen atoms are attached to one of the tetrahedra, and both of the carboxyl groups (COOH) are attached to the other one. The substance having this structure is actually known, and is called "methylene-malonic acid." Its properties are quite different, however, from those of maleic and fumaric acids, as might be inferred from the markedly different character of its structural diagram.

Tartaric acid affords an interesting example in stereo-chemistry, not only on account of its structure, but also because it was upon this acid and its modifications that Pasteur performed the classical experiments which led

Digitized by Google

(1860) to the development of the methods that are now used for the separation of optical isomers. The constitutional formula for tartaric acid as ordinarily written, is

```
         H
         |
HO — C — COOH
         |
HO — C — COOH
         |
         H
```

Each of the two central carbon atoms is here asymmetric, because each has its four bonds satisfied by four different substances. In the solid diagram for representing the structure of tartaric acid we shall therefore have to make use of two tetrahedra; and since the two nuclear carbon atoms are directly united by one bond, their corresponding tetrahedra will be symmetrically situated, and will have one vertex in common. In attaching the hydrogen, the hydroxyl (OH), and the carboxyl (COOH) to the vertices of the tetrahedra, we may adopt any one of three essentially different arrangements, for representing the relations expressed by the foregoing structural formula. These are shown in Figs. 7, 8, and 9. It will be observed, in Fig. 7, that the radicals and atoms that are attached to the vertices are so situated that the two tetrahedra would be superposable in all respects, if they were separated from each other. According to stereo-chemical theory, this signifies that the compound that Fig. 7 represents will rotate the plane of polarized lights by an amount equal to the sum of the effects of the two constituent asymmetrical tetrahedra. Turning now to Fig. 8, it will be seen that the two tetrahedra in this diagram also admit of superposition upon themselves, if they are separated; and hence the compound that this diagram represents will also rotate the plane of polarization by an amount that is equal to the sum of the effects that are due to its two constituent tetrahedra. It will be noted, however, that neither of the tetrahedra in Fig. 8 can be superposed upon either of those in Fig. 7; and this fact (when taken in connection with the identity of the two types of tetrahedra in all other respects) signifies that the compounds that are represented by Figs. 7 and 8 will rotate the plane of polarization by equal amounts, but in opposite directions. Fig. 7 may therefore be taken to represent dextro-rotatory tartaric acid, while Fig. 8 represents the lævo-rotatory variety of the same substance. In the configuration shown in Fig. 9, it will be observed that the two tetrahedra, if separated, cannot be superposed; for they are enantiomorphic, or respectively right-handed and left-handed. According to the theories of stereo-chemistry, one of these tetrahedra tends to cause the plane of polarization of polarized light to rotate to the right, while the other tends to rotate it by an equal amount to the left; and hence the substance, as a whole, will be optically inactive. In addition to these three varieties of tartaric acid (all of which are known and can be actually prepared), there is a fourth variety which is optically inactive, but which is not really chemically distinct from the varieties that have been described. This is known as "racemic acid," and it consists of a mere mixture of equal parts of the dextro-rotatory and lævo-rotatory acids.

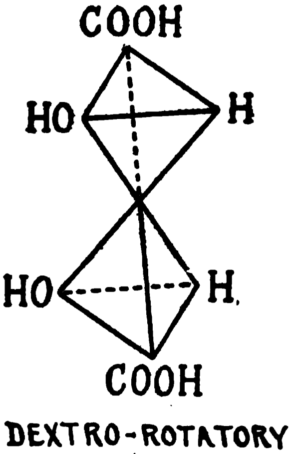


FIG. 7.

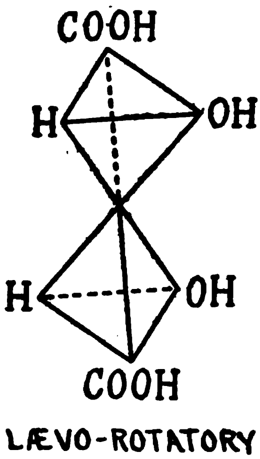


FIG. 8.

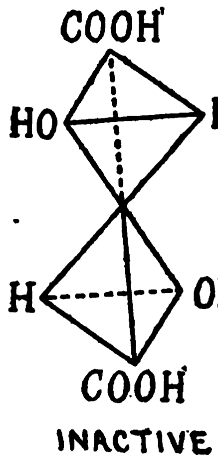


FIG. 9.

Constitution of the Isomers of Tartaric Acid.

The general facts of optical isomerism are thus stated by Nernst: (1) No compounds are optically active in the amorphous, homogeneous state (whether solid, liquid, or gaseous), save those which contain one or more asymmetrical carbon atoms in the molecule. (2) If several asymmetrical carbon atoms exist in the molecule,— for example, *two*,— then the rotations that are due to these respective atoms may be denoted by A and B, and the following combinations are possible, in the isomeric forms which the substance may exhibit:

$$A + B;\ -A - B;$$
$$A - B;\ -A + B.$$

The two substances corresponding to the first horizontal row are called "isomeric twins," since they produce equal rotations, but in opposite directions. If the compound has n asymmetrical carbon atoms, then the number of optical iso-

Digitized by Google

mers is $2n$, and two of these must be twins. (3) All compounds which contain asymmetric carbon atoms are not necessarily optically active; for the rotation that they produce may be too small to admit of detection; or the internal structure may be such as to produce internal optical compensation, as in the case of Fig. 9; or the compound may be a mixture of the dextro-rotatory and lævo-rotatory isomers, as in the case of racemic acid, already cited.

Optical isomers are often said to be identically alike in their chemical properties; but this is not rigorously true. The resemblance is exceedingly close, but certain slight differences are nevertheless observable, and these render the separation of the isomers possible. Special methods of separation may be adopted in special cases; but the three general methods that we have, and which are due to Pasteur, are as follows: (1) The mixed isomers are caused to combine with some other substance, whose isomeric compounds exhibit differences in melting point, solubility, or crystallization; and when the compounds have been separated by the usual methods applicable in such cases, they are separately decomposed so as to liberate the isomers of the original compound again. Pasteur separated racemic acid into its constituents by neutralizing it with cinchonine, separating the respective salts by crystallization, and then decomposing the respective cinchonine salts so as to liberate the two active varieties of tartaric acid. Ordinary lactic acid may be separated into its constituents by making use of the different solubilities of the lactates of zinc. (2) Certain microscopic organisms affect the various isomeric forms in different ways. Thus the mold fungus, Penicillium glaucum, when allowed to act upon a dilute solution of ammonium racemate, destroys the dextro-rotatory tartaric acid, while leaving the lævo-rotatory variety unaffected. (3) Sometimes the compounds of the dextro-rotatory and lævo-rotatory isomers crystallize in separate enantiomorphous crystals, from which the crystals of one type can be picked out by hand. This method was used by Pasteur with success in the case of sodium-ammonium racemate; but it is not of very general applicability, because the isomeric salts usually separate out together, in one mass.

In conclusion it may be well to say that it is not at all probable that the atoms of carbon compounds are actually arranged in space in accordance with the geometric representations that are adopted in stereo-chemical theory. The tetrahedron diagrams are exceedingly useful for representing the chemical facts as we know them in the laboratory; but we are still entirely ignorant of the actual way in which the atoms of compounds (whether carbon compounds or not) are arranged in space.

Consult: Van't Hoff, 'Stereochemie,' and 'Dix années dans l'histoire d'une théorie'; Hantzsch, 'Grundriss der Stereochemie'; and Nernst, 'Theoretical Chemistry,' together with the references therein given.

A. D. Risteen, Ph.D.,
Editorial Staff 'Encyclopedia Americana.'

Ster'eochromy, in art, a process of mural painting in which water glass is used to fix or consolidate the colors.

Ster'eogram, Parallax, a novel photographic transparency, the invention of Frederic E. Ives, which, without a stereoscope or other optical aid, shows the objects photographed in full stereoscopic relief, when viewed from a certain point, directly in front. It consists of (1) a single photograph on glass which is a composite in alternate fine vertical lines of the two halves of an ordinary stereogram, and (2) of an opaque line cover screen mounted upon it, with a separation of about $\frac{80}{1000}$ of an inch. The relative disposition of the lines of the photograph and those of the cover screen is such that by parallax of vision, each eye sees those lines and only those which make up the image belonging to that eye. They can be so made as to show the objects apparently standing in the air, either through and beyond the glass, or between the glass and the eyes. The large size of the photographs, and the absence of any visible optical aid, makes the results more realistic and impressive than by other means of stereoscopic representation.

Stereographic Projection, a name given that projection of the sphere which is represented on the plane of one of its great circles, the eye being situated at the pole of that great circle. All circles are projected either into straight lines or circles, and the angle made by two circles meeting on the globe is the same as that made by the projections of those circles. It is the projection generally employed in ordinary atlases. The distortion in the form of countries on the plane surface is very slight.

Stereopticon, a variety of magic lantern having two objective tubes that can be focused on the same part of a screen, and by the alternate projection of pictures from the separate tubes produce the well-known phenomenon of «dissolving views.» The stereopticon has been successfully adapted to the projection of instantaneous photographs of moving objects, producing the same effect of motion on the screen as observed in the kinetoscope. See Biograph; Magic Lantern.

Ster'eoscope, an optical apparatus which enables us to look at one and the same time upon two photographic pictures nearly the same, but taken under a small difference of angular view, each eye looking upon one picture only; and thus, as in ordinary vision, two images are conveyed to the brain which unite into one, the objects being thus represented under a high degree of relief. The stereoscope is constructed in accordance with the visual phenomena which convey to the mind impressions of the relative forms and positions of an object. When a near object having three dimensions is looked at, a different perspective representation of it is seen by each eye; in other words, there is distinct binocular parallax. Certain parts are seen by the right eye, the left being closed, that are invisible to the left eye, the right being closed, and *vice versa*, and the relative positions of the portions visible to each eye in succession differ. These two visual impressions are simultaneously perceived by both eyes, and are combined into one image, producing the impression of perspective and relief. If, then, truthful right-and-left monocular pictures of any object be so presented to the two eyes that the optic axes, when directed to them, shall converge at the same angle as when directed to the object itself, a solid image will

Digitized by Google

be seen. This is effected with the stereoscope, a reflecting form of which was invented by Professor Wheatstone in 1838. It is constructed so that the two dissimilar pictures are reflected to the eyes from two small plane mirrors placed at right angles, the faces being toward the observer. Subsequently Sir David Brewster invented the refracting or lenticular stereoscope, based on the refractive properties of semidouble convex lenses; and this instrument, of which there are numerous forms, is now in general use. Convex lenses magnify the pictures besides producing a stereoscopic effect. Photography greatly assists the stereoscope in providing perfectly accurate right-and-left monocular views, which are taken simultaneously on a plate in a twin camera. Sometimes, in the case of objects which from their distance have no sensible binocular parallax, photographs are taken from two points considerably apart; and when such views are combined in the stereoscope the effect of relief is greatly exaggerated. Several modifications of the reflecting stereoscope are distinguished by the names pseudoscope, iconoscope, telestereoscope, and polistereoscope, the last being an apparatus which serves the purposes of all the others. See CAMERA; OPTICS.

Stereoscopic Slide, a slip of cardboard on which are mounted side by side two photographs of the same scene or object. Theoretically, these photographs should be taken by similar lenses from points of view separated by a space equal to the distance between the human eyes, but in practice — especially in dealing with architectural groups — the space is increased in order to procure a greater effect.

Stereotrope, a mechanism by which an object is perceived as if in motion, and with an appearance of solidity or relief as in nature. It consists of a series of stereoscopic pictures, generally eight, of an object in the successive positions it assumes in completing any motion, affixed to an octagonal drum, revolving under an ordinary lenticular stereoscope, and viewed through a solid cylinder pierced in the entire length by two apertures, which makes four revolutions for one of the picture drum. The observer thus sees the object constantly in one place, but its parts apparently in motion, and in solid and natural relief.

Stereotype, a name given any body of fixed type; hence a plate cast from a plaster or papier-maché mold, on which is a facsimile of the page of type as set up by the compositor, and which, when fitted to a block, may be used under the press, exactly as movable type. See AMERICAN PUBLISHING.

Sterilization of Milk. See MILK.

Ster'ilized Food, any article of food which has been subjected to a sterilizing process that destroys the bacteria which cause fermentation and disease. Heat is the agent most commonly employed, and the process is more especially applied to milk. See FOOD PRESERVATION; MILK (*Sterilization and Pasteurization*).

Sterling, stėr'lĭng, **Antoinette**, American contralto singer: b. Sterlingville, N. Y., 23 Jan. 1850; d. London 11 Jan. 1904. As a child she already had a voice of great range, which developed into a rich, sonorous contralto. At 17 she began to take lessons in New York, and in the following year went to Germany, where she studied under Garcia and Marchesi. She made her London début in 1873 at a promenade concert conducted by Sir Julius Benedict. In 1875 she was married to J. Machinlay (d. 1893) and made her home in England. She sang in oratorio in the early part of her career, but afterward principally at concerts, singing English ballads and German art songs, which she was one of the first to introduce successfully in this country.

Sterling, John, Scottish author: b. Kames Castle, Isle of Bute, 20 July 1806; d. Ventnor, Isle of Wight, 18 Sept. 1844. He was graduated from Cambridge in 1824 and had attained some prominence in the literary world of London before his editorship with Frederick Denison Maurice of the 'Athenæum' in 1828. In 1833 he published a novel, 'Arthur Coningsby' and in 1839 'Minor Poems.' Three years later appeared 'The Election,' a poem, and 'Strafford,' a drama. His later work, accomplished during his years of declining health, includes also a series of prose poems published in Blackwood's, and eight cantos of 'Richard Cœur de Lion,' three of which were published posthumously in 'Frazer's Magazine,' and were much praised by his friend, Carlyle. A collection of his essays and tales was published with a memoir by J. C. Hare in 1848. Consult: Carlyle, 'The Life of John Sterling' (1851); also letters of Sterling and Ralph Waldo Emerson, with sketch of Sterling's life by Edward Waldo Emerson (1897).

Sterling, Ill., city in Whiteside County; on the Rock River, and on the Chicago & Northwestern and the Chicago, Burlington & Quincy R.R.'s; about 112 miles west of Chicago and 50 miles northeast of Rock Island. Electric lines connect the city with many of the nearby places. It was settled in 1834 by Hezekiah Brink; and founded as two places, Chatham and Harrisburg, in 1837. In 1839 they were consolidated, and on 16 Feb. 1857 organized as the village of Sterling. In 1872 it was reorganized under the Illinois general law. Sterling is in a fertile agricultural region, and its excellent water-power contributes to its manufacturing advantages. The chief industrial establishments are wire factories, gas engine works, coffin and hearse factories, flour mills, pump factory, foundries, machine shops, wagon factory, silver plating and hardware works. There are about 1,200 employees. There are 14 churches, a township high school, three graded schools, one parish school, and one business college. The two national, and one savings, banks have a combined capital of $225,000. The government is vested in a mayor and a council of 10 members elected every two years. Pop. (1890) 5,824; (1900) 6,309; (1910) 7,467. W. D. JOHN,
Manager 'Gazette.'

Sterling, Kan., city in Rice County; on the Atchison, T. & S. F., and Missouri P. R.R.'s. It is in an agricultural and stockraising region, and the principal industries are farming, salt mining, and milling. There are 13 churches, 3 public schools, Cooper Memorial College, one national and one state bank, and two weekly papers. Pop. (1910) 2,133.

Stern, Louis, American merchant: b. Germany 22 Feb. 1849. He recived a common

Digitized by Google

school education at Albany, N. Y., and removing to New York established the well known department stores of Stern Brothers. He was the Republican candidate for president of the borough of Manhattan in 1897, U. S. commissioner to the Paris Exposition of 1900, chairman of the executive committee, New York State commission to Louisiana Purchase Exposition (1904), and is president of the Republican Club.

Stern, Simon Adler, American author and banker: b. Philadelphia 8 Dec. 1838; d. 1904. He was educated in the high school, and in 1871 became associated with two of his brothers in the printing and publishing firm of Edward Stern & Co. He was treasurer of the Finance Company of Pennsylvania 1887-1903. In addition to many contributions on literature and music to the current periodicals, he published: 'Scintillations from the Prose Works of Heinrich Heine' (1873); translations of Auerbach's 'Woldfield' (1873), and 'On the Heights' (1875); and 'Jottings of Travel in China and Japan' (1888).

Sternberg, stĕrn'bĕrg, **George Miller,** American surgeon: b. Otsego County, N. Y., 8 June 1838. He was graduated from the College of Physicians and Surgeons, New York, 1860. He was appointed assistant surgeon in the United States army 28 May 1861; captain and assistant surgeon 28 May 1866; major and surgeon 1 Dec. 1875; lieutenant-colonel and deputy surgeon-general 12 Jan. 1891; and received the commission of brigadier-general, and surgeon-general in 1893. He was retired 8 June 1902. His first service during the Civil War was with the Army of the Potomac and later with the Army of the Gulf. After the war he was in charge of the United States General Hospital in Cleveland, Ohio, served through yellow fever and cholera epidemics, and during the war with Spain (1898), had command of the medical service. He was a member of the Havana Yellow Fever Commission, sent there by the National Board of Health (1879), and president of the American Medical Association (1898). He has published 'Photo-Micrographs, and How to Make Them' (1883); 'Bacteria, Malaria and Malarial Diseases' (1884); 'Manual of Bacteriology' (1893); 'Immunity, Protective Inoculations, and Serum-Therapy' (1897). In 1885 he was awarded the Lomb prize of $500 by the American Public Health Association for an essay entitled 'Disinfection and Individual Prophylaxis Against Infectious Diseases.'

Sternburg, Herman von Speck, German diplomat: b. Leeds, England, 21 Aug. 1852; d. Heidelberg, Germany, 24 Aug. 1908. He was educated at the Fürstenschule St. Afra, Meissen, Saxony, and the military academy of Potsdam, fought through the Franco-Prussian war in the 2d Saxon dragoons, and remained in the military service until 1885. In 1890 he entered on his diplomatic career, being made successively first secretary of legation at Peking, *charge d'affaires* at Belgrade, Servia, and first secretary of the embassy at Washington. In 1898 he was high commissioner on the Samoan commission; became consul-general for British India and Ceylon in 1900, minister plenipotentiary and envoy extraordinary to the United States in 1903, and ambassador in July 1903.

Sterne, stĕrn, **Adolphus,** Texan pioneer: b. Cologne, Germany, 5 April 1801; d. New Orleans, La., 27 March 1852. Leaving his birthplace in his 16th year to escape military duty, he came to the United States, going first to New Orleans and then visiting Texas in 1824. A lover of adventure and proficient in many languages and dialects, he joined the English settlers in their early struggles against the Mexicans, and took part in the Fredonian war. Saved from being sentenced to death by an amnesty, he went into business at Nacogdoches, and became a notable figure in eastern Texas. He studied law, was court interpreter, and after Texas won her independence he served in both upper and lower houses of Congress.

Sterne, Laurence, English humorist: b. Clonmel, Ireland, 24 Nov. 1713; d. London, 18 March 1768. He was a great-grandson of Richard Sterne, the master of Jesus College, who attended Laud to the scaffold and afterwards became archbishop of York. The archbishop's third son, named Simon, married Mary Jaques, heiress to the lordship of Elvington, near York, on the river Derwent, and subsequently purchased Woodhouse Hall in the parish of Halifax. Their eldest son Richard succeeded to the two estates. Jaques, the third son, entered the church, and rose to many dignities, including an archdeaconry. Between them was born Roger Sterne, father of the humorist, who turned for a career to the army. When a mere stripling, Roger Sterne was appointed an ensign in the thirty-fourth regiment of foot and passed the rest of his life in service on the continent or in English and Irish barracks. He took part in the siege and capture of Vigo and in the defence of Gibraltar. In 1711 he married at Dunkirk Agnes Hebert, of a humble Irish family and widow to a brother officer. Of their seven children only three lived beyond the fourth year. Laurence, the second child, was born on 24 Nov. 1713, at Clonmel, a small Irish town above Waterford on the Suir, where his mother was staying with friends. For 10 years the boy moved about with his parents from place to place, wherever the regiment happened to be stationed. Eventually the poor ensign left his family and went out to Jamaica, where he died of fever in 1731. As Laurence remembered him, Roger Sterne was "a little smart man * * * most patient of fatigue and disappointments * * * in temper somewhat rapid and hasty, but of a kindly, sweet disposition."

Long before this, Laurence had been placed, by the aid of his uncle Richard, in the Halifax grammar school, where he was kept at his accidence for some seven years, and then sent to Cambridge on an allowance of £30 a year. Laurence Sterne was admitted to Jesus College as a sizar in 1733, and the next year he was elected to one of several scholarships founded by his great grandfather. At the university the young man in no way distinguished himself, and in after life he ridiculed the curriculum. Graduating A. B. in January 1736-7, he was ordained deason in the following March. In 1738, he was admitted to the priesthood, and obtained, through the influence of his uncle Jaques, the vicarage of Sutton-in-the-Forest, eight miles from York. To this preferment was soon added the neighboring Stillington and a prebendal stall in

Digitized by Google

York minster. On 30 March 1741, he married Elizabeth, daughter to Robert Lumley, sometime rector of Bedale, and immediately settled in the parsonage at Sutton. He lived there for 20 years. Two daughters were born, of whom only Lydia reached maturity. Besides officiating in his two parishes and taking his turns at preaching in the cathedral, the vicar cultivated his glebe and purchased two farms for larger crops of oats and barley. He amused himself with fiddling and painting, read hundreds of books on all sorts of subjects, and visited extensively among convivial squires. Possessing a facile pen, he wrote for a time political articles for his uncle Jaques, and twice he appeared in print with a sermon. A pamphlet of his called 'A Political Romance' (January 1759) brought to a gay close a hot dispute then waging in the York chapter. Aware now that he could write so as to make his reader laugh, he began 'The Life and Opinions of Tristram Shandy Gent,' the first two volumes of which were given to the public in December 1759. In the following March Sterne went up to London and met his great fame. After seeing through the press a second edition of his book and two volumes of sermons, he returned to the north and settled at Coxwold, a parish at the foot of the Hambleton Hills, which had been bestowed upon him by Lord Fauconberg. In the parsonage there, renamed Shandy Hall, Sterne went on with his comic romance, nine volumes in the whole, which appeared in further instalments near the beginning of several years down to 1767. Two more volumes of sermons were issued in 1765.

Never strong, Sterne broke down in January, 1762, and hurried across the channel. After a brief stay in Paris, where statesmen, philosophers, and the world of fashion crowded about him, he moved south to Toulouse, where he was joined by wife and daughter. He remained in southern France till the summer of 1764, when he returned alone to Coxwold. His health failing again, he set out for France in October, 1765, on his famous sentimental journey. He traveled mostly by chaise from Calais via Montreuil to Paris, on to the south through Languedoc and then crossing over into Italy on to Rome and Naples. He was back at Coxwold in the summer of 1766. All this time his wife and daughter remained abroad. While in London for the winter of 1766-67, Sterne met and fell in love with Mrs. Elizabeth Draper, wife to a writer in the service of the East India Company. She sailed for India in April, 1767, and poor Yorick was left broken-hearted. Mrs. Draper is the Eliza of the 'Sentimental Journey' and of a series of letters. After her departure for India, Sterne had a serious illness from which he barely recovered. In June he returned to Coxwold, where he recorded his sensations from day to day in a journal he kept for Eliza, and began 'A Sentimental Journey through France and Italy.' In the following January he went up to London with the new book, which was published on 26 Feb. 1768. He soon took to his bed, and died 18 March 1768, at his lodgings in Old Bond street. At the time he was alone save for a nurse and a footman whom friends had sent to inquire after him. Four days later he was buried in Saint George's cemetery on the Bayswater Road. According to a story which is probably true, his body was taken up and sold for dissection to the professor of anatomy at Cambridge. The next year Mrs. Sterne swept his study for three more volumes of sermons; and in 1775, Lydia, then Mrs. Medalle, brought out her father's letters and brief autobiography.

Sterne's career appeals strongly to the imagination. An obscure country parson till his forty-seventh year, he at once became known throughout western Europe. Everybody wished to see the man who had written 'Tristram Shandy.' In London and in Paris there always awaited him "dinners a fortnight deep." A letter addressed to "Mr. Tristram Shandy, Europe," was handed him by the postboy on the way to Sutton. When Lessing heard of Yorick's death, he said that he would gladly have given him five years from his own life. The book which drew Sterne out of obscurity was a strange performance. It starts out with the prenatal history of the hero, for the purpose of satirizing Dr. John Burton, a local accoucheur, and then shunts off into the life and opinions of the hero's father and uncle Toby. Once in the swing of character-creation, the author only incidentally returns to his main narrative. To Horace Walpole, the book seemed to have been written backwards. For the amusement or perplexity of the reader, a chapter is begun, then broken off for a new one, and pages are left blank, or misnumbered. But there is method in this madness. Sterne was a great master of digression; for in spite of every apparent drawback his narrative moves on; and from it finally emerge Parson Yorick, Mr. Walter Shandy, my uncle Toby, and Corporal Trim, a rare company of eccentrics, among the most completely elaborated characters in English literature. The devious journey has also been accompanied by the most delightful ridicule of pedantry and musty learning, with a stop here and there on the strangest whims and fancies, like my uncle Toby's fly or his brother's philosophy of names. Everywhere sentiment ripples on into the kindliest humor.

The 'Sentimental Journey' is less quixotic in structure. Though based upon the author's travels, it is not a journey in the ordinary sense. It is rather a record of Yorick's sensations as he refuses alms to a poor Franciscan, takes by the hand a beautiful woman, and counts her pulse-beats, or stops to listen to the story of a peasant girl in distress, or best of all when he sees a Marquis before the estates of Rennes reclaim a sword that he had been compelled to lay aside twenty years before. One sentimental portrait fades into another by the most delicate transition of feeling. It is all a high and wonderful art.

Bibliography.—In 1780, Sterne's original publishers issued his works in ten volumes. Of the numerous reprints, the best is the one edited by J. P. Brown (London 1873). It includes some additional letters. The convenient edition by Saintsbury (6 vols. London 1894) omits most of the sermons. The 'Works and Life' (12 vols. New York 1904), edited by Cross, contains the recently recovered 'Journal to Eliza,' additions to the correspondence, Mrs. Draper's letters to friends in England, a body of anecdotes, and the 'Life' (annotated) by Fitzgerald. This standard biography by Fitzgerald, published in 1864, was revised in 1896,

Digitized by Google

and reprinted in 1905. **Consult also:** Traill's 'Laurence Sterne' in 'English Men of Letters Series' (London and New York 1882); Stapfer's 'Laurence Sterne, sa personne et ses ouvrages' (Paris 1870); and Thackeray's 'English Humorists.' Of more special interest are Texte's 'Rousseau et le cosmopolitisme littèraire au XVIII.ème siècle' (Paris 1895); and Thayer's 'Laurence Sterne in Germany,' with a bibliography (New York 1905).

WILBUR L. CROSS,
Professor of English, Yale University.

Sterne, Simon, American lawyer and economist: b. Philadelphia 23 July 1839; d. New York 22 Sept. 1901. He studied at the University of Heidelberg, was graduated from the law department of the University of Pennsylvania in 1859, and was admitted to the bar of New York in 1860. He represented many corporate interests, and paid special attention to real estate and constitutional law. He found time to take part in social and civic reform, lectured on political science at Cooper Institute (1861–3), and was secretary of the committee of 70 for the overthrow of the Tweed Ring (1870). He was appointed in 1875 on a commission to devise plans for the government of cities, and in 1895 on a commission to recommend changes in methods of administration, and by President Cleveland in 1896 to report as to the relations of western European governments to railways. Besides a large number of articles on historical and political economic subjects, he published: 'Representative Government' (1871); 'Suffrage in Cities' (1878); 'Hindrances to Prosperity' (1879); 'Constitutional History and Political Development of the United States' (1882). Consult Foord, 'Life and Public Services of Simon Sterne' (1903).

Sterne, Stuart. See BLOEDE, GERTRUDE.

Ster'ner, Albert Edward, American artist: b. London, England, 8 March 1863. He studied at Julien's Academy and the Ecole des Beaux Arts, Paris, and in 1881 came to the United States, opening his studio in New York in 1885. He has painted in oil acceptably, but is best known for his illustrations, which are effectively drawn and possess refinement and charm.

Sternhold, stĕrn'hōld, **Thomas,** English hymnologist: b. Blakeney, Gloucestershire, about 1500; d. August 1549. He was one of the versifiers of the first metrical version of the Psalms, long used in public worship in churches, but superseded by the version of Tate and Brady, published in 1698. He was educated at Oxford, became groom of the robes to Henry VIII., and held a similar office under Edward VI. The principal coadjutor of Sternhold in his versification of the Psalter was John Hopkins. The first edition (1548) contained 19 psalms, the second (1549) 37 psalms translated by Sternhold, the third (1551) includes 7 translated by Hopkins. In 1562 appeared 'The Whole Book of Psalms.'

Sternum, the breastbone in vertebrates. See ANATOMY, COMPARATIVE; ORNITHOLOGY; OSTEOLOGY.

Ster'rett, James Macbride, American college professor: b. Howard, Pa., 13 Jan. 1847. He was graduated from the University of Rochester 1867, studied at the Cambridge Episcopal Theological School, and was ordained priest in the Protestant Episcopal Church 1873. He was professor of ethics at the Seabury Divinity School, Faribault, Minn., 1882–92, and since the latter date has been professor of philosophy at Columbian University, D. C. He is president of the Society for Philosophical Inquiry and is the author of 'Studies in Hegel's Philosophy of Religion' (1890); 'Reason and Authority in Religion' (1891); and 'The Ethics of Hegel' (1893).

Sterrett, John Robert Sitlington, American college professor: b. Rockbridge Baths, Va., 4 March 1851. He was educated at the universities of Virginia, Leipsic, Berlin, Athens, and Munich. He was professor of Greek at Miami University, 1886–91; at the University of Texas, 1888–92; at Amherst College, 1892–1901; and has been head of the Greek department at Cornell University since 1901. He was a professor in the American School of Classical Studies at Athens, Greece, 1896–7, has led various archæological expeditions to Asia Minor, and is a joint editor of the 'American Journal of Archæology.' Among his publications are 'Qua in re Hymni Homerici quinque majores inter se differant' (1881); 'Inscriptions of Tralles' (1885); 'Notebook of a Traveling Archæologist' (1889); etc.

Stesichorus, stĕ-sĭk'ō-rŭs, Greek poet: b. Himera, Sicily, about 640 B.C.; d. Catana 555 B.C. His own name, Tisias, he changed to Stesichorus ("conductor of the choric ode") as the inventor of strophe, anti-strophe, and epode, and with his predecessor Alcman he stands at the head of Dorian poets of the lyric dance. He incurred the wrath of Phalaris by the warning and poetic appeals which he addressed to his townsmen in view of the tyranny of that prince and died in exile. His fragments are collected in Bergk's 'Poetæ Lyrici Græci.'

Steth'oscope, an instrument, the invention of Lænnec (q.v.), ordinarily consisting of a short wooden tube, from 7 to 12 inches long, widening toward each end, with which physicians are accustomed to examine the internal state of the human body in diseases of the lungs and other internal organs, also in hernia, and in the condition of women in pregnancy, etc. This is done by applying the stethoscope to the chest or abdomen, and putting the ear to the wider end. Many disorders may be distinguished very clearly in this way, and the instrument has proved most useful to the medical profession. The binaural stethoscope is now a common form, the instrument having two flexible tubes, the ends of which are applied to both ears simultaneously.

Stet'son, John Batterson, American philanthropist: b. Orange, N. J., 5 May 1830; d. near Deland, Fla., 18 Feb. 1906. He engaged in hat manufacture and founded the John B. Stetson Company, with the largest factories in the world. Connected with them are reading-rooms, library, armory, etc. He built Stetson Hall for Deland University at Deland, Fla., and added other endowments, the name of the institution being changed to the John B. Stetson University.

Stettin, stĕt-tēn', Germany, **in Prussia,** capital and port of Pomerania, and of the government of Stettin, on the Oder, 60 miles northeast of Berlin. The Old and New towns are distinct sections. Since the removal of the fortifications (1873) the town has extended greatly and several outlying villages have become incorporated in the main town. Both the Oder and

Digitized by Google

the Parnitz, a tributary, are spanned by several bridges. There are numerous public squares, embellished by statues of German sovereigns and other celebrities. There are many churches, of which the church of Saint James (14th century) and Saint Peter's (1124) are most noteworthy, also a fine synagogue. Of secular buildings may be mentioned the royal palace (1346), now used for government purposes; the old town-hall, bourse or exchange, asylum, orphan-home, concert-hall and club, arsenal, schools of architecture, technical school, etc. Stettin is Germany's chief port and an important ship-building centre. The industries are varied and include iron-foundries, engineering works, manufactures of ready-made clothing, chemical, cement, soap, oil, paper and pasteboard works, sugar refineries, and famous breweries and distilleries. In 1898, a free harbor east of the Lastadie suburb was opened. A ship canal, connecting Stettin with Berlin, will be a new impulse to trade. The imports include coal, iron, soda and potash, seeds, coffee, cotton, wine, corn, herrings, timber; the exports are: sugar, timber, liquor, grain, potatoes and flour. In the 12th century Stettin had already attained considerable importance. In 1121, Boleslas, Duke of Poland, introduced Christianity. The Treaty of Westphalia ceded the town to the Swedes, and it subsequently became a possession of Prussia. Pop. (1900) 210,680.

Steuart, stū'art, **John Alexander,** Scottish novelist: b. Perthshire 3 July 1861. After traveling extensively in North America he entered journalism, and returning to Europe settled in London and was editor of 'The Publishers' Circular' (1896–1900). He has published 'A Millionaire's Daughters' (1888); 'Letters to Living Authors' (1890); 'The Eternal Quest' (1901); 'A Son of God' (1902); etc.

Steuben, stū'bĕn (Ger. stoi'bĕn), **Friedrich Wilhelm August Heinrich Ferdinand,** Baron von, Prussian soldier and American general: b. Magdeburg, Prussia, 15 Nov. 1730; d. Steuben, Oneida County, N. Y., 28 Nov. 1794. Before coming to America he had attained the rank of lieutenant-general in the Prussian army, and had won distinction in the Seven Years' war. At its close he retired from military life, but was persuaded by colonial representatives in France to come to the assistance of the American people. He at once became an enthusiastic supporter of the American cause, and, tendering his services to Congress in 1777, was assigned to the main army under Washington at Valley Forge. His splendid discipline and ability as an organizer were at once recognized by Washington, who recommended his appointment as inspector-general of the entire army. Unable to attain a separate command in the open field, he spent most of his time recruiting the forces sent to those who took a more prominent part in the war; but it was undoubtedly due to his almost unrecognized efforts that the American troops were from the first so well-organized and disciplined a body. He attained at last his coveted place as an officer in the line, and as major-general of the forces at Yorktown received the first offer of capitulation from Lord Cornwallis. Refusing to be relieved by Lafayette, he was allowed to remain in the trenches until the complete surrender of the enemy. At the close of the war he was refused the pecuniary remuneration which he had asked of the colonies in the event of their success, but to recuperate his fortunes, abandoned for their cause, was subsequently awarded several grants of land, among them a township in northern New York, where he spent the remainder of his life. Consult: Sparks, 'American Biography'; Kapp, 'Life of Steuben' (1860).

Steubenville, stū'bĕn-vĭl, **Ohio,** city, county-seat of Jefferson County; on the Ohio River, and on the Pittsburg, C., C. & St. L., the Cleveland & P. division of the Pennsylvania, the Wabash (Wheeling & L. E.) R.R.'s; about 68 miles below Pittsburg, Pa., and 23 miles north of Wheeling, W. Va.

History.— In 1786 a fort was built on the site of what is now a business portion of the city; but no permanent settlement of home-seekers was made until 1797, when frontier houses were erected by Bezaleel Wells, Benjamin Doyle, John Ward, and others. In 1798 the place was laid out as a town, and in 1851 was incorporated as a city. It was a place of importance from the time the fort was built; in 1810 there was a population of 800. It was one of the first places to use steam for manufacturing purposes.

Industries.— The city is in an agricultural and coal and gas region. Natural gas is nearby, so that it is brought to the city by pipes and pumping. Coal is under and around the city and is mined extensively. Valuable clay deposits are in the vicinity, and petroleum wells are within a few miles. Large quarries, from which is obtained excellent building stone, contribute to the prosperity of the city. The chief manufacturing establishments are iron and steel works, soap works, tin plate and clay works, potteries, foundries, glass factories, blast furnaces, a paper mill, flour mills, boiler works, tube works, machine-shops, and nail factories. The government census of 1900 gives the number of manufacturing establishments, 171; the amount of capital invested, $2,587,180; the number of employees in the manufacturing establishments, 2,051; annual amount of wages, $874,095; cost of material used, $2,698,875; and value of products annually, $5,235,161. Brick works near the city form part of the industrial wealth of the city.

Municipal Improvements.—Steubenville is far enough above the river, being laid out on the second terrace, as to be beyond the flood section. Hills ranging in height from 300 to 500 feet are on three sides, thus greatly modifying the inclemency of the cold winds. The water supply comes from the river, at a point about two miles above the city. The location and slope give excellent surface drainage, and there is a good system of artificial drainage. Vitrified brick is used largely for paving. Large trees shade the streets, so that in summer the city presents some the appearance of a dense grove. The Gill Hospital and the local charitable organizations care for the sick and the needy.

Churches and Schools.— There are 18 churches: 4 Presbyterian, 3 Methodist, 2 Methodist for colored, 2 Protestant Episcopal, 2 Roman Catholic, 1 each of Methodist Protestants, United Presbyterians, Disciples of Christ, Congregationalists, and Jewish. There are well-organized school systems. The high school was

Digitized by Google

STATUE OF BARON VON STEUBEN.

Digitized by Google

Digitized by Google

opened in 1860; there are public and parish schools, private commercial schools, a Carnegie Public Library, and school libraries.

Banks and Finances.— The four banks have a combined capital of $1,450,000. The resources are $5,000,000. There are two private banks and two building and loan associations. In 1900 the municipal receipts were $167,216.95, and the expenditures, $95,185.13. The chief expenses were for schools, street repairs, cleaning, and lighting, and charitable and penal departments.

Population.— The majority are native-born; but there are a number of Germans and Italians, and a few English and Irish of foreign birth. The population increases each year, and the city has a regular, healthy growth. Pop. (1890) 13,394; (1900) 14,349; (1910) 22,391.

Stevens, stē'vĕnz, Alfred, Belgian painter: b. Brussels 11 May 1828; d. Paris, France, 24 Aug. 1906. He studied under Navez at Brussels and Roqueplan at Paris, and won a first-class medal at the Paris Exposition of 1867. He soon evinced striking talent in portraying fashionable and elegant life in Paris of to-day— such as the lady in her boudoir, with all the bright, piquant accessories added in a spirit as suggestive, but not so bitter as that which characterized Hogarth, although his later pictures which take their subjects from common life had a distinctly ethical motif. Among his best-known canvases are: 'The New Year's Gift'; 'Innocence'; 'The Allegory of Spring'; 'The Visit'; 'The Parisian Woman turned Japanese'; 'Morning in the Country'; etc. He also painted for the king of the Belgians four figures in fresco representing the four seasons,— female figures in modern costume. His 'Five O'Clock Tea' is in the Vanderbilt collection, New York.

Stevens, Alfred George, English sculptor: b. Blandford, Dorsetshire, 1818; d. London 1 May 1875. He was educated at the village school, and for a time followed his father's trade of house-painter. The assistance of a friend enabled him to study painting, architecture, and sculpture in Italy, where he lived from 1833 till 1842, being for some time a pupil of Thorwaldsen. After his return to England he became a teacher for two years in the School of Design. He is to be looked upon as one of the most important figures in the history of English sculpture. He was a follower of Michelangelo and the Renaissance, yet broke completely with the English tradition of stiff classicality, and worked naturally and freely at the dictates of his own individuality, bringing about something like a revolution in the ideals of English statuary. His influence was more active after his death, and during his lifetime his genuine strength and greatness were only known to the few. His great work is the monument to the Duke of Wellington in Saint Paul's. Consult: Stannus, 'Alfred Stevens and His Work' (1891); Armstrong, 'Alfred Stevens: a Biographical Study' (1881).

Stevens, Ebenezer, American soldier: b. Boston 1752; d. 1823. He was one of the Massachusetts colonists who took part in the memorable demonstration in Boston harbor in 1773, and was an active revolutionist from 1775 to the close of the war, having raised three Massachusetts companies for the siege of Quebec, and having served as a commander in the battles of Ticonderoga, and later in the Virginia campaign. He was also an officer in the War of 1812, where he was engaged in the defense of the New York frontier.

Stevens, Edward, American soldier: b. Culpeper County, Va., 1745; d. there 17 Aug. 1820. In 1776 he became colonel of the 10th Virginia regiment, the next year checked the forces of General Howe at the battle of the Brandywine, and after serving with distinction at Germantown, was appointed brigadier-general. He served later at Camden, Guilford Court House, and at the siege of Yorktown, his gallantry being highly commended. After the adoption of the Virginia State constitution he was a member of the state senate till 1790.

Stevens, Edwin Augustus, American inventor, son of John Stevens (1749–1838): b. Hoboken, N. J., 1795; d. Paris 7 Aug. 1868. He made numerous experiments in steam navigation and in 1861 urged the government to put into service his projected ironclad floating battery, but the offer was declined. He inherited a large fortune from his father and his brother and endowed the Hoboken high school, and bequeathed $1,000,000 to establish at Hoboken the Stevens Institute of Technology (q.v.).

Stevens, Edwin Augustus, American mechanical engineer, son of the preceding: b. Philadelphia 14 March 1858. He was graduated at Princeton in 1878 and has since resided at Hoboken, N. J., where he has been director and trustee in various corporations. He is best known as having designed the first screw ferry-boat.

Stevens, George Barker, American professor of theology: b. Spencer, N. Y., 13 July 1854; d. New Haven, Conn., 22 June 1906. He was graduated from the University of Rochester in 1887: held pastorates in a Congregational and a Presbyterian church, 1880–5; studied in Germany, 1885–6; and became professor of New Testament criticism at Yale University in 1886. From 1895 till his death he was Dwight Professor of Systematic Theology in the Yale Divinity School. His publications include: 'The Pauline Theology' (1892); 'The Theology of the New Testament' (1899); 'The Teaching of Jesus' (1901); etc.

Stevens, Isaac Ingalls, American military officer: b. Andover, Mass., 18 March 1818; d. near Chantilly, Va., 1 Sept. 1862. He was graduated at the United States Military Academy in 1839, and served in the Mexican war as adjutant of engineers. From 1849 to 1853 he was in charge of the coast survey at Washington. In 1853 he resigned from the army to become governor of Washington Territory. At the outbreak of the Civil War he was made colonel of the 79th New York regiment. He was made a major-general 4 July 1862. He was killed while leading a charge at Chantilly.

Stevens, John, American inventor: b. New York 1749; d. Hoboken, N. J., 6 March 1838. In 1787, having accidentally seen the imperfect steamboat of John Fitch, he at once became interested in steam propulsion, and experimented constantly for the next 30 years on the subject. In 1789 he petitioned the legislature of New York for a grant of the exclusive navigation of the waters of that State. The peti-

Digitized by Google

tion was accompanied with drafts of the plan of his steamboat, but the right was not granted. In 1804 he constructed a propeller, a small open boat worked by steam, and his success was such that he built the Phenix steamboat, which was completed but a very short time after Fulton had finished the Clermont. Fulton having obtained the exclusive right to the navigation of the Hudson, Mr. Stevens placed his boats on the Delaware and Connecticut. In 1812 he published a remarkable pamphlet urging the government to make experiments in railways traversed by steam carriages. The first steam ferry in the world was established by him. His locomotive model (1826) was exhibited in operation and it has been claimed as the first locomotive run on a track in this country. His other inventions and improvements were many and various.

Stevens, John Austin, American author: b. New York 21 Jan. 1827; d. 16 June 1910. He was graduated at Harvard in 1848, and was the founder and for many years editor of 'The Magazine of American History.' He wrote 'The Expedition of Lafayette again Arnold'; 'The Burgoyne Campaign'; 'Progress of New York in a Century'; 'The French in Rhode Island.' and 'Life of Albert Gallatin' (1883).

Stevens, John Leavitt, American writer and diplomat: b. Mt. Vernon, Maine, 1 Aug. 1820; d. Augusta, Maine, 8 Feb. 1895. He was ordained in 1844 in the Universalist ministry, but was obliged to give up the profession, in 1854, on account of ill-health. He became associated with James G. Blaine on 'The Kennebec Journal' in 1855, went to the Maine legislature 1865-8, and to the state senate 1868-70. He was minister from the United States to Uruguay and Paraguay 1870-3; and to Norway and Sweden 1877-83. In 1889 he was sent as minister to the Hawaiian Islands, and in 1890 his rank was raised to that of envoy extraordinary and minister plenipotentiary. In 1893, having placed the islands, then in revolution, under the protection of the United States, Stevens was recalled by President Cleveland, who did not approve of his course. He is the author of 'The History of Gustavus Adolphus' (1884), and a collaborator on 'Picturesque Hawaii' (posthumous 1897).

Stevens, Phineas, American soldier: b. Sudbury, Mass., 20 Feb. 1707; d. Chignecto, N. S., 6 Feb. 1756. At 16 he was carried captive by the Indians from Rutland, Mass., to Saint Francis, Canada, and learned their mode of warfare. During King George's War he commanded Fort No. 4, now Charlestown, N. H., and he held this post successfully against the French and Indians till the close of the war. He was sent to Canada in 1749 to negotiate for exchange of prisoners and again in 1752. For journal of his trip in 1749 consult 'New Hampshire Historical Collections.'

Stevens, Robert Livingston, American inventor: b. Hoboken, N. J., 18 Oct. 1787; d. there 20 April 1856. He was a son of John Stevens, inventor. He early became interested in steam navigation and made many improvements in the construction of vessels, among which was that of giving concave water lines to the hull. In 1813 he invented the beam-engine, percussion shells for smooth-bore guns, and in 1836 introduced the T-rail on the Camden and Amboy Railroad, of which he was president. He made many improvements on the marine engine.

Stevens, Sheppard. See STEVENS, SUSAN SHEPPARD PIERCE.

Stevens, Susan Sheppard Pierce, American novelist: b. Mobile, Ala., 18 Sept. 1862. She was a daughter of Rt. Rev. H. N. Pierce, bishop of Arkansas, and was married in 1882 to W. C. Stevens, son of Rt. Rev. W. B. Stevens. She has published: 'I am the King' (1898); 'The Sword of Justice' (1899); 'In the Eagle's Talon' (1902); 'The Sign of Triumph: a Romance of the Children's Crusade' (1904).

Stevens, Thaddeus, American statesman: b. Danville, Vt., 4 April 1792; d. Washington, D. C., 11 Aug. 1868. He was graduated at Dartmouth College in 1814; went to York, Pa., where he taught school; studied law, and began to practise in Gettysburg. In 1828 he joined the Whig party, and began to act in politics. He worked with the party of anti-Masonry (q.v.), and took part in its Baltimore convention (September 1831). In 1833 and for several succeeding years he was a member of the Pennsylvania legislature, acted with the Whigs, and became distinguished through his opposition to slavery. At the State constitutional convention in 1836, to which he was a delegate, he advocated negro suffrage. During his legislative career he was engaged in fighting the party "machine," and in the end came off victorious. He was appointed a canal commissioner in 1838, and rendered important services to the State in developing its system of internal improvements. Removing to Lancaster, Pa., in 1842, he there engaged for six years in the practice of law. In 1848 and again in 1850 he was elected to Congress, where he strongly opposed the fugitive-slave law (see FUGITIVE-SLAVE LAWS), the Kansas-Nebraska Bill (q.v.), and other measures involving concessions to Southern interests. Again in 1858 he was elected to Congress, and became the acknowledged leader of the House, in which he remained as such until his death. Throughout the Civil War he was chairman of the Committee on Ways and Means, and afterward held the chairmanship of the Committee on Reconstruction. He reported from that committee the Reconstruction Act of 1867, having previously (1865) assisted in framing the Wade-Davis Reconstruction Bill. (See UNITED STATES.) He was also chairman of the House committee which had charge of the impeachment of Andrew Johnson (q.v.). Stevens was a man of boundless energy and tenacity of will, with the intenseness of a zealot in the cause which he espoused; and in respect to slavery his radicalism outran that of all its other congressional opponents. Consult: McCall, 'Thaddeus Stevens,' in 'American Statesmen Series' (1899).

Stevens, Walter B., American journalist: b. Meriden, Conn., 25 July 1848. He was graduated from the University of Michigan in 1870; and has since been connected with Saint Louis newspapers. In 1904 he was made secretary of the Louisiana Purchase and World's Fair Exposition at Saint Louis. He has published: 'Through Texas'; 'The Ozark Uplift.'

Digitized by Google

Stevens Institute of Technology, located at Hoboken, N. J. It owes its foundation to Edwin A. Stevens, who, in his will, bequeathed land, $150,000 for buildings, and $500,000 endowment for "an institution of learning." A charter was obtained in 1870, and the institution opened to students in 1871; in 1875 a mechanical laboratory was established. The Institute is essentially a school of mechanical engineering alone, and it offers but one course of study, which requires four years for its completion. This course includes instruction in English, German, French (or Spanish), electrical engineering, and business engineering. There is also an academic department. Much attention is given to practical laboratory and workshop training. There is a department of tests in which are undertaken measurements of the performance of steam-engines and other motors, of the efficiency of boilers, electrical and hydraulic apparatus, of the strength of materials and kindred problems. It grants the degree of mechanical engineer to those who have completed its course of study, and it has bestowed honorary degrees of doctor of philosophy and doctor of engineering. Its government is in the hands of a board of 12 trustees, one of the number being an alumnus. There are 11 scholarships and a loan fund for the assistance of poor students. In 1901 an engineering laboratory, the gift of Andrew Carnegie, was completed, and in 1903 plans for the Morton Laboratory of Chemistry were under consideration. Since the original bequest of Mr. Stevens it has received considerable additions to its endowment fund, and its former president, Dr. Henry Morton, was among the liberal donors; the productive funds in 1910 amounted to $800,000. The library contained 10,000 volumes, the students numbered 399 and the faculty 34. In 1902 Alexander C. Humphreys, Sc.D., was appointed president.

Stevens Point, Wis., city, county-seat of Portage County; on the Wisconsin River, and on the Wisconsin Central and the Green Bay, W. & St. P. R.R.'s; about 20 miles northeast of Grand Rapids and 100 miles north of Madison. It is the commercial and industrial section of the southern part of a rich pine district, and has extensive lumbering interests. The river furnishes good water-power. The chief manufacturing establishments are several lumber mills, planing mills, foundries, flour mills, railroad shops, machine shops, and furniture factories. The government census of 1900 gives the number of manufacturing establishments, 107; the amount of capital invested, $2,197,025; the number of wage-earners in manufacturing works, 979; annual amount of wages, $390,800; cost of raw material, $1,391,413; and value of the products, $2,171,265. The educational institutions are private commercial schools, a high school, public and parish schools, and a public library. Two national banks have a combined capital of $150,000, and one state bank has a capital of $60,000. Pop. (1910) 8,692.

Stevenson, stē'vĕn-sŏn, **Adlai Ewing,** American statesman: b. Christian County, Ky., 23 Oct. 1835. He was educated at Centre College, Danville, Ky., but without graduating removed to Bloomington, Ill., in 1852. He was admitted to the bar in 1857, and was master in chancery from 1860 to 1864. He took an active part in politics as a Democrat, and in 1875–7 and 1879–81 represented Illinois in the National House of Representatives. In 1885 was appointed first assistant postmaster-general, and after the renomination of Grover Cleveland in 1892 was chosen the candidate for the vice-presidency. The Democratic candidates were elected, and after the expiration of his term he was appointed a member of the American commission to visit Europe and endeavor to secure the adoption of international bimetallism. In 1908 he was Democratic candidate for the governorship of Illinois.

Stevenson, Andrew, American statesman: b. Virginia 1784; d. Blenheim, Va., 25 June 1857. He studied law, attained a prominent position at the bar, in 1804 was elected to the house of delegates of Virginia, and after being a member for several sessions was chosen speaker. In 1821 he was elected a representative in Congress, and for 13 years held that office, for the last six of which he was speaker of the House. He was minister to England from 1836 to 1841, and on his return became rector of the University of Virginia.

Stevenson, Burton Egbert, American writer: b. Chillicothe, O., 9 Nov. 1872. He was educated at Princeton University, which he left in 1893 to enter newspaper work. In 1894 he was city editor of the Chillicothe *Daily News* and in 1898 held a similar position on the *Daily Advertiser*. Since 1899 he has been librarian of the Chillicothe public library. He has published: 'At Odds with the Regent' (1900); 'A Soldier of Virginia' (1901); 'The Heritage' (1902); 'Marsan' (1903).

Stevenson, David Watson, Scottish sculptor: b. Ratho, Midlothian, 25 March 1842; d. 17 March 1904. He was educated in art at the Royal Scottish Academy and under William Brodie (1857). In 1860 he executed the bronze group 'Labor' and the following year that of 'Learning,' both for the Scottish National Prince Consort Memorial. He also executed public statues for Oldham, Middlesborough, Paisley, Dunoon, and Baltimore, Md. His ideal statues include 'Eve'; 'Echo'; 'Hero'; 'Godiva'; and 'Pompeian Mother.' His work is conservative to the point of conventionality and exhibits no trace of modern influences or originality of conception.

Stevenson, John James, American college professor: b. New York 10 Oct. 1841. He was graduated from New York University in 1863 and has been professor of geology in his alma mater since 1871. He was United States geologist 1873–4, 1878–80; was the geologist of the Pennsylvania geological survey 1875–8, 1881–2; and was president of the New York Academy of Sciences 1896–8. He has published several geological treatises, among which are 'Geology of a Portion of Colorado' (1875); 'Report on Greene and Washington Districts, Pa.' (1876); 'Geology of Bedford and Fulton Counties, Pa.' (1882); etc.

Stevenson, Robert, Scottish engineer: b. Glasgow 8 June 1772; d. Edinburgh 12 July 1850. Having studied engineering, he was appointed engineer and superintendent of Scottish lighthouses. In 1843 he had constructed 23 lighthouses on the coast of Scotland. He was the originator of the intermittent or flash light

Digitized by Google

now in general use. The famous Bell Rock Lighthouse, described in the Diary of Sir Walter Scott, was built by Stevenson in 1807-10 after overcoming tremendous difficulties.

Stevenson, Robert Louis (baptised Robert Lewis Balfour), Scottish novelist, essayist, and poet: b. 8 Howard Place, Edinburgh, 13 Nov. 1850; d. Vailima, island of Upolu, Samoa, 3 Dec. 1894. He was the only child of Thomas Stevenson, an eminent light-house engineer,—as his father, Robert Stevenson, had been before him,—and Margaret Isabella, daughter of the Rev. Lewis Balfour, of Colinton in Midlothian. He was a playful, imaginative child; was fond of being read to, and commenced to compose (by dictation) at the age of six. His health was infirm from the first; but he was tended and kept alive by a devoted nurse, Alison Cunningham, to whom he remained affectionately grateful throughout his life. His schooling was irregular and inconsecutive; and even while attending school he showed a truant disposition. On his many rambles, he always took a copy-book, in which he tried to fit into words his impressions of people and places, imitating the cadences of his favorite authors. In 1867 he entered Edinburgh University, and studied engineering with a view to following the family profession. He showed, however, little interest in this; though in 1871 he won a silver medal for a paper on light-house apparatus. The same year he gave up engineering, and began to study law. He was called to the bar in 1875; but immediately forsook the legal profession also, and turned his attention entirely to letters.

Acute nerve exhaustion and danger to the lungs forced him to spend the winter of 1873 at Mentone. In 1874 he joined the Savile Club in London, and soon made friends with many of the most prominent literary men of the day, including Sidney Colvin, William Ernest Henley, Edmund Gosse, Andrew Lang, Walter Pollock, Leslie Stephen, Cosmo Monkhouse, Sir Walter Simpson, George Meredith, and Prof. Fleeming Jenkin. His social charm was irresistible, and he was noted for the brilliancy and ardor of his talk. Henley's sonnet, 'Apparition,' gives a vivid description of him at this period. He practised writing constantly. In April 1875, he made his first visit to the artist haunts of Fontainebleau, in company with his painter cousin, R. A. M. Stevenson. In 1876, in company with Simpson, he took the canoe trip from Antwerp to Grez, which he afterward narrated in his first book, 'An Inland Voyage' (1878); and in 1878 he went alone upon the tramping trip which resulted in 'Travels with a Donkey' (1879). These little books of travel stamped him already as a master of English prose style, though they were written with more elaborate mannerism than he showed in his maturer work. Meanwhile, beginning 1876, he contributed to the *Cornhill* and other magazines the critical essays later collected in 'Familiar Studies of Men and Books' (1882), and the bracing and vigorous papers on life and the living of it, collected in 'Virginibus Puerisque' (1881). As a critic he showed thorough study and sympathetic insight, and as a moralist he displayed a militant gaiety and bracing bravery of spirit. His first published stories were 'A Lodging for the Night' (1877), 'The Sire de Malétroit's Door' (1878), and 'Will o' the Mill' (1878). His first volume of fiction was 'New Arabian Nights,' which appeared serially June to October 1878. These early stories showed at once his romantic love for the poetry of circumstance, and his mastery of rapid and brilliant narrative.

Soon after the inland voyage of 1876, Stevenson met in France an American lady, Mrs. Fanny Van de Grift Osbourne, for whom he conceived almost immediately a devotion that changed the entire course of his life. Her domestic circumstances had been unhappy, and on her return home in 1878, she took steps to obtain a divorce from her husband. Learning her determination, Stevenson resolved to follow her, and started suddenly for California in August 1879. He undertook the journey against the remonstrances of his family and friends. He was very short of funds; and therefore crossed the ocean in the steerage, and traversed the continent in an emigrant train. The experiences of this double journey he afterward narrated in 'The Amateur Emigrant' and 'Across the Plains.' On board ship he wrote 'The Story of a Lie,' under stress of immediate need for money. The hardships that he genially endured resulted in a general breakdown of his health. From September to December 1879, he lived at Monterey and worked incessantly. In December 1879, he moved to San Francisco, where for three months he lived in a workman's lodging, and was reduced almost to the point of death by enforced frugality and excessive labor. Mrs. Osbourne nursed him back to life. She was now free from her former husband, and Stevenson married her in May 1880. Immediately afterwards, in order to insure his recovery, the couple moved to a deserted mining camp in the California Coast Range. An account of their experiences here is given in the 'Silverado Squatters.'

In August 1880, Stevenson brought his wife to England, where she was enthusiastically welcomed by his parents and friends. During the next two years he spent his summers in Scotland and his winters, on account of his precarious health, at Davos Platz, in Switzerland, where he enjoyed the companionship of John Addington Symonds. At Davos he completed 'Treasure Island,' a stirring narrative for boys, both young and old, that made his fame as an artist in romance. It appeared serially in *Young Folks* from October 1881 to January 1882, and was published in book form in 1883. The author received £100 for the book rights of the story, and was delighted at the price, little knowing how the work was destined to endure. From 1882 to 1884 he lived in the south of France, partly at Marseilles and Nice, but chiefly at Hyères. In 1884 he returned to England and settled at Bournemouth, where he remained till 1887. His health was at its lowest ebb during this period. A great part of his time was spent necessarily in bed; often, because of his tendency to hemorrhages, he was forbidden to speak aloud. In spite of this handicap, he kept cheerfully at work, and produced, besides many minor stories of the highest merit, the graceful and urbane romance, 'Prince Otto' (1885), the thrilling and adventurous 'Kidnapped' (1886).

Digitized by Google

'The Strange Case of Dr. Jekyll and Mr. Hyde' (1886), that terrible and searching tale of the good and bad in man. In 1885 he also published 'A Child's Garden of Verses,' a collection of poems showing such unsophisticated memory and intimate understanding of childhood as to make its author the poet laureate of the nursery. During the same period he composed four plays in collaboration with W. E. Henley; but his attempts in the dramatic form were never of great importance. In 1887 appeared 'The Merry Men and Other Tales,' a volume which collected some of his most artistic novelettes and short stories, among them being 'Markheim,' a grim tale of conscience and remorse; and also 'Memories and Portraits,' a collection of papers chiefly autobiographical.

The death of Stevenson's father in May 1887, severed the strongest tie which bound him to the old country; and weary of battling for health in an unpropitious climate, he accepted the advice of his physicians to try a complete change of surroundings. Accordingly, with his wife and mother, he sailed to America in August 1887. He spent the next winter at Saranac Lake, in the Adirondack Mountains. His main work that season was the preparation of twelve articles for *Scribner's Magazine*, which appeared one a month through 1888, and the composition of a large part of 'The Master of Ballantrae,' perhaps his most attractive romance. Among the *Scribner* papers were several of his greatest essays on literature and life,—for example, 'The Lantern Bearers,' 'Pulvis et Umbra,' and 'A Christmas Sermon.' In June 1888, he crossed the continent to San Francisco; and being subsidised by large advance orders for travel letters and other literary work, sailed forth with his entire family on the schooner yacht *Casco* for a long voyage to the South Sea Islands. His first extensive stay was at Honolulu, 1889, where he completed 'The Master of Ballantrae' and also 'The Wrong Box,'—the latter in collaboration with his step-son, Mr. Lloyd Osbourne. Thence, in the schooner *Equator*, he proceeded to Samoa and Sydney. From Sydney, after voyaging to many islands on the steamer *Janet Nicoll*, he returned to Samoa, bought an estate named Vailima on a mountain slope above Apia in the island of Upolu, and determined to settle there for good. From 1891 to his death he lived at Vailima, building a great house and dwelling with a feudal dignity emulous of Scott's at Abbotsford. He was beloved by all the natives,—who called him "Tusitala," teller of tales,—took an active interest in Samoan affairs, and became, by the force of his engaging personality, a real power in the land. At Vailima he produced 'The Wrecker' and 'The Ebb Tide,' both in collaboration with Mr. Osbourne; a sequel to 'Kidnapped,' called 'Catriona, or David Balfour'; a collection of 'Island Nights Entertainments'; sundry writings about Samoan affairs; and three-quarters of a romance called 'St. Ives,' completed after his death by Mr. A. T. Quiller-Couch. In all of this work he was aided by his step-daughter, Mrs. Isobel Strong, who proved to be a devoted amanuensis. He also commenced 'Weir of Hermiston,' which gave promise of being by far the greatest of his novels. He labored on this book with feverish intensity until the very day of his death. The end came suddenly. With characteristic gaiety of spirit, he was making a salad on the veranda, when a blood-vessel burst in his brain. He lost consciousness immediately, and died within two hours. The Samoans bore his body to the summit of Vaea Mountain, where he lies buried.

Bibliography.—All the material really necessary for a study of Stevenson is comprised in the Edinburgh and Thistle Editions, including the 'Life,' by Graham Balfour, and the 'Letters,' edited by Sidney Colvin.

CLAYTON HAMILTON,
Sometime Tutor in English, Columbia University.

Stevenson, Sara Yorke, American archæologist: b. Paris, France, 19 Feb. 1847. She was educated in Paris, came to America in 1862, and in 1870 was married to Cornelius Stevenson. She received the degree of Sc.D. from the University of Pennsylvania, the first degree ever conferred on a woman by that institution. In 1897 she went to Rome on a special mission for the departments of archæology and palæontology of the University of Pennsylvania, and in 1898 was sent to Egypt for the American Exploration Society, to make investigations in connection with archæological work in the Nile Valley. She has published 'Maximilian in Mexico' and 'The Book of the Dead.'

Steward, in common usage, a head servant who attends to domestic matters in a house, club, hotel, or other establishment. (1) On shipboard an officer whose duty it is to distribute provisions to the officers and men. In passenger ships, a man who superintends the distribution of provisions and liquors, waits at table, etc. (2) A fiscal agent of certain bodies; as, the recording steward of a congregation of Methodists. (3) The Lord High Steward of England was one of the ancient officers of state, the greatest under the crown. A lord high steward is now made only for particular occasions, such as a coronation or the trial of a peer. (4) The Steward of the Household, an officer of the English royal household, who is head of the court called the Board of Green Cloth, which has the supervision of the household expenses and accounts. He selects the officers and servants of the household, and he appoints the royal tradesmen.

Stewart, stū'ạrt, **Alexander P.,** American military officer: b. Rogersville, Tenn., 2 Oct. 1821; d. Biloxi, Miss., 30 Aug. 1908. He was graduated from the Military Academy in 1842 and after serving in the artillery for three years resigned from the army. When the Civil War came Stewart was appointed a major of artillery by Governor Harris of Tennessee. His promotion was rapid. He was made a major-general on 2 June 1863, and lieutenant-general on 23 June 1864, almost a year before the close of the War. In 1868 he accepted the chair of professor of mathematics in the University of Mississippi, and from 1874 to 1886 was chancellor.

Stewart, Alexander Turney, American merchant: b. Belfast, Ireland, 12 Oct. 1803; d. 10 April 1876. He came to the United States in 1823 and engaged in teaching. In 1825 he founded in New York a dry goods business which gradually expanded into one of the largest

Digitized by Google

mercantile concerns in the world. He was at one time considered the wealthiest man in the United States and was a giver of large sums of money to various charitable institutions, and was active in many philanthropic undertakings. He was buried in Saint Mark's churchyard, from which his remains were stolen on 7 Nov. 1878. The remains were afterward recovered and deposited in the mausoleum of the Cathedral of the Incarnation, erected by Mrs. Stewart in memory of her husband at Garden City, Long Island.

Stewart, Alvan, American lawyer and reformer: b. South Granville, Washington County, N. Y., 1 Sept. 1790; d. New York 1 May 1849. He moved with his parents to Vermont, where in 1809 he entered Burlington College. He spent some time in Canada in 1811–12, but in the latter year returned to college. During the War of 1812 he again went to Canada, and was held as a prisoner. On his return to the United States he studied law and began the practice of his profession at Cherry Valley, N. Y., where he rapidly attained success. In 1832 he moved to Utica, and continued his practice, but gave a large share of his time and attention to the temperance and anti-slavery causes. His first anti-slavery speech was delivered in 1835; in 1837 he called and organized an anti-slavery convention at Utica, which was, however, soon dispersed by mob violence. He was the leader in New York State in forming an independent political party to promote the abolition of slavery, and was that party's candidate for governor. Among his most famous speeches are that delivered before the New Jersey Supeme Court to establish the unconstitutionality of slavery in the State under the Constitution of 1844, and one delivered in 1837 to prove that Congress could constitutionally abolish slavery. His speeches were edited by L. R. Marsh and published under the title ‹Writings and Speeches of A. Stewart on Slavery.›

Stewart, Balfour, Scottish physicist: b. Edinburgh 1 Nov. 1828; d. near Drogheda 18 Dec. 1887. He was educated at Dundee and later at the University of Edinburgh. In 1859 was appointed director of the observatory at Kew; in 1870 professor of physics, Owens College, Manchester. He is best known by his investigations into the absorption and radiation of heat; and his remarkable meteorological studies, especially those understaken in collaboration with De la Rue and Loewy on the physical constitution of the sun, and with Tait on the generation of heat in a vacuum. He devoted most of his later labors to the study of terrestrial magnetism. His main discovery on the subject of heat constituted a remarkable extension of what is known as Prévost's «Law of Exchanges,» and he has established the fact that radiation is not a surface phenomenon, but takes place throughout the interior of the radiating body, and that the radiative and absorptive powers of a body must be equal. He published ‹Elementary Treatise on Heat› (1866); ‹The Conservation of Energy› (1872); ‹Terrestrial Magnetism› in the ‹Encyclopedia Britannica,› 9th ed., etc. Consult ‹Men and Women of the Time,› 12th edition.

Stewart, Charles, American naval officer: b. Philadelphia, Pa., 28 July 1778; d. Bordentown, N. J., 7 Nov. 1869. He entered the navy as a lieutenant on board the frigate United States and served on this vessel among the West Indies and against French privateers. In 1804 he took command of the Siren in operations against Tripoli. In 1813 he commanded the Constitution in a cruise to the Guiana coast and the Windward Islands which resulted in the capture of the British schooner Piston and a number of merchant vessels. In 1815 he made a second cruise in the same vessel and captured two large British ships, the Cyane and the Levant. In 1816–20 he commanded a squadron in the Mediterranean and from 1821–3 he had command of a Pacific squadron. In 1857 he was placed on the retired list, but two years later took charge of the Philadelphia Navy Yard which office he held for three years, when he was retired as rear-admiral.

Stewart Dugald, Scottish philosopher: b. Edinburgh 22 Nov. 1753; d. there 11 June 1828. He was the son of Matthew Stewart who for 25 years was professor of mathematics at Edinburgh University, and there young Dugald studied from 1765 to 1769, devoting himself to mathematics and philosophy. In the latter subject his teacher was Adam Ferguson. In 1771 Stewart went to Glasgow, partly to prepare himself as a candidate for one of the Snell scholarships at Oxford, and partly to attend the lectures of Thomas Reid who came to exercise a profound influence on the young student. In 1772 he was called upon by his father, whose health was failing, to teach the mathematical classes in the University of Edinburgh. In 1775 he was elected joint professor and acted in that capacity till 1785. During Ferguson's absence on a political mission in America in 1778–9, Stewart also had charge of the courses in philosophy, and upon the resignation of Ferguson in 1785 was chosen to succeed him and continued in the active duties of his class for 25 years. His field embraced a wide array of subjects: psychology, logic, metaphysics, ethics, natural theology, the principles of taste, politics, and last of all, political economy. In 1792 appeared the first volume of the ‹Elements of the Human Mind,› followed in 1793 by the ‹Outlines of Moral Philosophy.› In the same year he read before the Royal Society of Edinburgh his ‹Account of the Life and Writings of Adam Smith›; in 1796 came the ‹Account of the Life and Writings of Principal Robertson,› and in 1802 the ‹Account of the Life and Writings of Dr. Reid.› In 1806 he received a sinecure office worth £300 a year. The death of his second son in 1809 proved a severe blow for his health, otherwise indifferent, and he was unable to conduct his lectures during the following session. Thomas Brown was appointed as conjoint professor and Stewart passed the rest of his life in retirement. In 1810 he published his ‹Philosophical Essays,› in 1814 the second volume of the ‹Elements of the Human Mind,› in 1815 the first part, and in 1821 the second part of ‹A Dissertation on the Progress of Metaphysical, Ethical, and Political Philosophy since the Revival of Learning›; in 1827 the third volume of the ‹Elements›; and in 1828, a few weeks before his death, the ‹Philosophy of the Active and Moral Powers.› Stewart has little claim to be considered an original thinker, and his chief importance rests in the success which attended his attempt to expound the philosophy

Digitized by Google

of Thomas Reid. From the latter he differed chiefly in his more sympathetic attitude toward the Cartesian philosophy, and in certain principles of psychology, notably those connected with the subject of association. A gifted orator and possessed of an extremely attractive personality, Stewart attained very great popularity as a lecturer and he was successful in implanting in the minds of his hearers a profound respect for the value of philosophic thought and the standards of a lofty morality. His works, in 11 volumes, appeared in 1854–8.

Stewart, Matthew, Scottish mathematician: b. Rothesay 1717; d. Edinburgh 23 Jan. 1785. He studied at the University of Glasgow, and in 1746 published his 'General Theorems of Considerable Use in the Higher Parts of Mathematics.' In 1761 he published 'Tracts Physical and Mathematical,' and in 1763 'Propositiones Geometricæ More Veterum Demonstratæ.'

Stewart, Robert, marquis of Londonderry. See CASTLEREAGH.

Stewart Island, New Zealand, the smallest and southernmost of the three main islands composing New Zealand (q.v.). It is separated by Foveaux Strait from the southern extremity of South Island. Its area, together with the neighboring islets, is 665 square miles, and its population about 300.

Stewing, in cookery, a mode of preparing meat and fruit for the table by simmering the materials in a saucepan or stewpan with a little more water than is sufficient merely to keep them from burning. In stewing meat the great art is to keep down the temperature so as to avoid the hardening of the fibres and the too rapid coagulation of the albumen by heat. Stewpans are now almost always rather shallow vessels, with closely fitting lids, and when used may be heated on a hot plate, or kept at a proper distance from an ordinary fire.

Steyer, stī'ĕr, or **Steyr,** stīr, Austria, at the junction of the Steyer with the Enns, 19 miles southeast of Linz. The town proper has two suburbs connected by bridges, and there are three public squares, one of which contains beautiful fountains. The buildings are typically Italian: The parish church is modeled on Saint Stephen's of Vienna; the town-hall is embellished by a graceful tower; the Castle of Lemberg (10th century) stands upon a rocky height overlooking the rivers; there are several monuments, a grammar-school, technical and industrial schools, museum, etc. Steyer is one of the most important manufacturing cities of Austria, and very wealthy. The factories for iron and steel, paper, calico, bell-founding, dyeing, and the small-arms factory, where bicycles are now produced, are among the most important of the country. The historical interest of the town centres in the treaty of peace concluded in 1800 (Christmas) between Austria and France.

Steyn, stīn, **Martinus Theunis,** Boer statesman: b. Winburg, Orange Free State, 2 Oct. 1857. He was educated at Grey College, Bloemfontein, at Wevente, Holland, and studied law at the Inner Temple, London. Returning to South Africa he practised law at Bloemfontein during 1883–9. In the latter year he was made state attorney, and second puisne judge 1889–93. He was made first puisne judge for 1893–6 and afterward elected president of Orange Free State. His term of office was to expire in 1901; but in October 1899 he influenced the government of Orange Free State to join the Transvaal Republic in its contest with Great Britain, and when active hostilities commenced he took the field in person. His tenure was ended by the submission of the country and its formal annexation, 28 May 1900, to Great Britain as the Orange River Colony.

Stibiodomeykite, an antimonial variety of the mineral domeykite. It occurs in large quantities in the Mohawk mine, Michigan, with other closely related minerals, all of which are of commercial importance because they are rich copper ores and also contain small percentages of nickel and cobalt.

Stib'nite, Antimonite, or **Antimony-glance,** the only important ore of antimony. It crystallizes in the orthorhombic system and forms not only in acicular crystals often radially grouped, but also, in Japan, in magnificent groups of large crystals, prismatic and deeply striated vertically, which are undoubtedly among the finest of mineral specimens. The crystals are often twisted, while angular bends, due to gliding planes, are very common. Massive, granular, and columnar forms also occur. Brachypinacoidal cleavage is highly perfect. Though flexible, even when in large, stout crystals, and slightly sectile, it seems very brittle because of its easy cleavage. It is very soft, hardness 2; specific gravity 4.6; lustre metallic, splendent; color and streak lead-gray, becoming black and often iridescent on exposure to light. Chemically it is antimony trisulphide, Sb_2S_3. It fuses even in large pieces in the flame of a candle and is number one in the scale of fusibility. It occurs in many localities throughout central Europe, in England, China, Mexico, New Brunswick, and in the United States in Arkansas, Utah, California, and elsewhere. See also ANTIMONY.

Stick-insects. See WALKING-STICK.

Stick'it Minister, The, and Some Common Men, a collection of short stories by Samuel Rutherford Crockett, published in 1893.

Stick'leback, a small fish of the family *Gasterosteidæ,* order *Hemibranchii,* in which the rays of the first dorsal fin form a series of detached spines. The body is elongated and compressed and tapers behind to a narrow caudal peduncle. Teeth exist in both jaws, but are absent from the tongue and palate. The premaxillary is protractile. The sides of the body may be covered with vertical bony plates, while the other parts are destitute of any scaly covering. These fishes inhabit the rivers and brackish waters of temperate climates of the northern hemisphere. The brook stickleback (*G. bispinosus*), very common on the New England and New Jersey coasts and sometimes in fresh water, is a voracious little fish, swimming eagerly after bait of all kinds, and not at all disturbed by noises and acts which would infallibly frighten away most other fishes, and highly pugnacious, especially at their breeding season. In its reproductive habits it evinces many most interesting features, constructing a nest and attending its young with care and affection. The nest is the size of a large hickory-

Digitized by Google

nut, and is composed of vegetable matters, pieces of straw, sticks, and the like, bound together with a silky fibre secreted by an organ closely connected with the kidneys of the male. In the top of the nest a small pit is formed in which the eggs are deposited. These are about the size of poppy seeds, and are bright-yellow. Over this nest and its contained ova these fishes watch with the most jealous care, the male taking upon himself almost the entire duty of nidification, as well as of tending the young after hatching.

The genera *Eucalia, Pygosteus,* and *Apeltes* are all represented in the salt or fresh waters of the United States, where are found seven species of these interesting little fishes, each exhibiting individual peculiarities in appearance and habits.

Consult: Gill, 'Standard Natural History,' Vol. III. (Boston 1885), and Ryder, 'Bulletin United States Fish Commission' (Washington 1881).

Stickney, stĭk'nĭ, **Albert,** American publicist: b. Boston 1 Feb. 1839; d. 4 May 1908. He graduated from Harvard University 1859, and from Harvard Law School 1862. During the Civil War he was lieutenant-colonel of the 47th Massachusetts Vounteers; aide on the staff of Major-General Banks, and inspector-general on the staff of Major-General Emery. He published 'The Lawyer and his Clients'; 'A True Republic'; 'The Political Problem'; 'The Transvaal Outlook' (1900); 'Organized Democracy' (1906).

Stigand, stĭg'and, **William,** English clergyman: b. 1002; d. 1064. He enjoyed great favor with King Edward, who in 1044 made him royal chaplain and bishop of Elmham or of the East Angles. Eight years later the bishop mediated successfully in the interests of peace between the king and Earl Godwin, and was rewarded with the archbishopric of Canterbury. Stigand received the pallium from Pope Benedict X. On the death of Harold, Stigand gave his vote for Edgar Atheling to be king, and for this reason, and because he was a firm friend of the House of Godwin, William the Conqueror distrusted him, and induced the Pope to send a commission of cardinals, who deprived him of his dignities and sentenced him to perpetual imprisonment. But Stigand died shortly afterward in Winchester; it is said he was starved to death.

Stig'ma (plural, **Stigmas, or Stigmata**), a mark made with a red-hot iron; a brand impressed on slaves and others; also a small red speck on the human skin, causing no elevation of the cuticle. In botany, the part of the pistil to which the pollen is applied. It is generally situated at the upper extremity of the style. In religious meaning, stigmata is a term borrowed from Gal. vi. 17, "I bear in my body the marks (Greek and Vulgate, *stigmata*) of the Lord Jesus." See STIGMATIZATION.

Stig"matiza'tion, derived from the Greek word *stigma,* a puncture, the name applied by Roman Catholic writers to the impression on certain individuals of the "stigmata," or marks of the wounds which our Lord suffered during the course of His Passion. In the early days many Christians branded the name of Christ on their foreheads, and various voluntary mutilations for Christ's sake were practised by enthusiasts. The stigmata comprise not only the wounds of the hands and feet, and that of the side, received in the crucifixion, but also those impressed by the crown of thorns and by the scourging. The most remarkable example of stigmatization is that narrated of Saint Francis of Assisi and occurring in 1224, on the mountain of Alverno. Being absorbed in rapturous contemplation of the Passion of Christ, he saw a seraph with six shining wings, blazing with fire, and having between his wings the figure of a man crucified, descend from heaven and approach him, so as to be almost in contact. After a time the vision disappeared, leaving the soul of Francis filled with reverence and awe. And now he became aware that in hands, feet, and side he had received externally the marks of crucifixion. These mysterious marks continued during the two years until his death, and are declared by the saint's biographers to have been seen by many eye-witnesses, including Pope Alexander IV.

The Dominicans openly disputed the fact, but at length made the same claim for Catharine of Sienna, whose stigmata were explained as at her own request made invisible to others. The Franciscans appealed to Sixtus IV., and that pope, himself a Franciscan, forbade representations of Saint Catharine to be made with the stigmata. Still the fact is recorded in the breviary office, and Benedict XIII. granted the Dominicans a special feast in commemoration of it. Many others, especially women, are enumerated as having received all or some of the stigmata. Among these is the very notable case of Saint Veronica Giuliani, who is said to have received in 1694 first the marks of the crown of thorns, and afterward those of the crucifixion. More recent cases are those of Anna Katherina Emmerich (1774–1824), who became a nun at Agnetenberg; "L'Ecstatica" Maria von Mörl of Caldaro (1839); Louise Lateau (1850–83, in 1868), whose stigmata were stated to bleed every Friday; and Mrs. Girling (1827–86, about Christmas 1864), of the New Forest Shaker community. Dr. Imbert Gourbeyre, in his work 'Les Stigmatisées' (1873), enumerates 145 persons, of whom but 20 were men, as having received the stigmata, and of these 80 lived before the 17th century. Apart altogether from the question of the value of the evidence offered, we may reasonably conclude that some kind of stigmatization is a pathological condition of occasional occurrence. The Roman Catholic Church is extremely cautious in giving credence to cases of stigmatization as genuinely supernatural.

Stikine, stĭk-ēn', also called **Stakhin,** etc. A tribe of the Koluschan linguistic stock of North American Indians, about the mouth of Stikine River, southern coast of Alaska. They are divided into the Wolf and the Raven clans. In 1880 they numbered 317 in eight villages, but by 1890 they had diminished to 255.

Stil'bite, one of the commonest of the zeolite family of minerals. Though crystallizing in the monoclinic system, its crystals simulate rhombic forms on account of their twinning which is uniformly present and which is revealed by polarized light under the microscope by the division into sectors whose extinction angles are 10°. These twin crystals are often grouped into the curious sheaf-like

Digitized by Google

bundles so characteristic of the species. Clinopinacoidal cleavage is perfect; fracture uneven; brittle; hardness 3.5 to 4; specific gravity 2.2; lustre vitreous, pearly on the clinopinacoid; color usually white or yellowish, though not infrequently brownish to brick-red; transparent or translucent. Essentially a hydrous silicate of aluminum and calcium, generally with a little soda. Before the blowpipe it acts like scolecite (q.v.). It mostly occurs in cavities in trap rocks. Many localities have yielded fine specimens, among the most important being Poona, India; Iceland; Faröe Islands; Nova Scotia; Paterson and Upper Montclair in New Jersey. Sphærostilbite and puflerite are globular varieties.

Stilicho, stĭl'ĭ-kō, **Flavius**, Roman general: b. of Vandal origin about 359 A.D.; d. Ravenna 23 Aug. 408. In 384 A.D. he was sent by the emperor on an important mission to Persia, and upon his return was made commander-in-chief of the Roman army and given the hand of Serena, the niece of Theodosius, in marriage. At the death of the emperor he was made guardian of his son Honorius, and practical ruler of the Western Empire, which he defended against the invasion of the Goths under Rufinus, the guardian of the Empire of the East. Although he again repulsed the Germanic hordes in 406, and was the loyal servant of the empire in its foreign wars, having defeated Alaric at Pollentia some years before the Gothic invasion, he was accused of aiding Alaric in his encroachments upon the empire previous to its final conquest, and was obliged to flee from Rome. On the charge of high treason he was taken from the church at Ravenna which had given him shelter and executed. His distinguished services in behalf of Rome were commemorated by the poet Claudius. Consult Gibbon, 'Decline and Fall of Rome.'

Stiles, stīlz, **Charles Wardell**, American zoologist: b. Spring Valley, N. Y., 15 May 1867. He was educated at Wesleyan University, Conn., 1885–6; Collège de France 1886–7; Berlin University 1887–9; Leipsic University 1889–90; Trieste Zoological station 1891; Pasteur Institute and Collège de France 1891. He was zoologist, 1891–1902, and has been consulting zoologist since 1902, in the bureau of animal industry, United States Department of Agriculture. He has been zoologist of the United States Public Health and Marine Hospital Service since August 1902; professor of medical zoology at Georgetown University since 1892; at Johns Hopkins University since 1897; and was a special lecturer on that subject at the Army Medical School 1894–1902. He has held other offices with national and private scientific institutions, has represented the United States government at several International Zoological Congresses, and was detailed as agricultural and scientific attaché to the United States Embassy, Berlin, 1898–9. His publications, all on the subject of his special study, include 'A Revision of the Adult Cestodes of Cattle, Sheep, and Allied Animals' (1893); 'Tapeworms of Poultry' (1896); 'The Cattle Ticks of the United States' (1902); 'Report on Hook Worm Disease in the United States' (1903); etc.

Stiles, Ezra, American clergyman and college president: b. North Haven, Conn., 15 Dec. 1727; d. New Haven, Conn., 12 May 1795. He was graduated from Yale in 1746, and was a tutor there 1749–55. Dr. Franklin having sent an electrical apparatus to Yale, Stiles entered with great zeal upon this then new field of philosophical investigation, and performed the first electrical experiments ever made in New England. At the time he was pursuing the study of theology, was licensed, and commenced preaching in June 1749. In April 1750 he visited the Housatonic tribe of Indians at Stockbridge. He then studied law, in 1753 was admitted to the bar, and practised at New Haven for the two following years. In 1775 he became pastor of the Second Church in Newport, R. I., and during his residence there found time for literary and scientific investigations, corresponding with learned men in almost every part of the world. His congregation at Newport being entirely broken up by the British occupation of the place, in May 1777 he removed to Portsmouth, N. H., to become pastor of the North Church. In September following he was elected president of Yale, shortly after professor of ecclesiastical history in connection with the presidency, and in June 1778 entered on his official duties. After 1780 he discharged the duties of professor of divinity. His labors for the college were intense and uninterrupted during the residue of his life. He was widely learned, being perhaps particularly versed in the Oriental languages. He published a funeral oration in Latin on Gov. Law (1751); a Latin oration on his induction to his office as president (1778); an 'Account of the Settlement of Bristol' (1785); 'History of Three of the Judges of Charles I.' (1795). His life has been written by Kingsley in Sparks' 'American Biography,' 1st series, Vol. VI. (1845).

Stilet'to, a knife or dagger with a round pointed blade from 6 to 12 inches long, common in the Middle Ages.

Still, John, English ecclesiastic: b. Grantham, Lincolnshire, about 1543; d. Wells 26 Feb. 1607–8. He was graduated from Christ's College, Cambridge, of which he was elected a fellow, and took orders. In 1570 he became Margaret preacher and Margaret professor of divinity in the university. The next year he obtained the rectory of Hadleigh, Suffolk, and in 1572 became, with Dr. Thomas Watts, joint dean of Bocking, at the same time being appointed chaplain to the primate. In 1573 he was made vicar of East Markham and canon of Westminster, whereupon he resigned his Cambridge professorship. He was then promoted to the deancy of Norwich and in July 1574 was elected master of St. John's College, Cambridge. Having acted as vice-chancellor in 1575, he was in May 1577 transferred to the mastership of Trinity. In 1592 he was again elected vice-chancellor and was called upon to provide an English comedy for the queen's amusement. In 1593 he was consecrated bishop of Bath and Wells. The supposition that he was the author of 'Gammer Gurton's Needle' (q.v.) is highly probable. In 1575 the play was published under the following title: 'A Ryght Pythy, Pleasant, and Merie Comedie: Intytuld Gammer Gurton's Nedle: Played on Stage not longe ago in Christes Colledge in Cambridge. Made by Mr. S., Master of Art,' and this Mr. S. can be

Digitized by Google

identified with no one so naturally as with the vice-chancellor, Dr. Still, of the time.

Still, William, American philanthropist: b. Shamony, N. J., 7 Oct. 1821. He was chairman and corresponding secretary of the Philadelphia branch of the Underground Railroad 1851–61. He sheltered the wife, daughter, and sons of John Brown while he was awaiting execution in Virginia. He has published 'The Underground Railroad'; 'Voting and Laboring'; 'Struggle for the Rights of the Colored People of Philadelphia.'

Still. See DISTILLATION.

Still-life, a branch of the art of painting which deals with the portrayal of lifeless objects. It is called in Germany, *Still Leben;* in Holland, *stilleven;* in France, *nature morte;* in Italy, *riposo*. The subjects generally chosen are dead animals — deer, birds or fish, kitchen and table utensils, plate, crockery or china, fruit, flowers, curios, and jewelry. These objects are arranged so as to make a picturesque combination of color, light, and shade. Some still-life pictures are extremely refreshing compositions executed with consummate technique. This branch of art flourished from the earliest days of color decoration, and was at its highest perfection during the Alexandrian age; the paintings at Pompeii and the Roman mosaics furnish many fine examples of it. The Renaissance painters did not execute still-life as an independent department of their art, but early in the 17th century it was cultivated most elaborately and with the greatest success by the Dutch school. The taste, beauty, and exquisite virtuosity of their work has never been surpassed, if ever even equaled. There are two main styles of still-life painting. While some artists have endeavored by a certain breadth and freedom of handling to obtain a mere decorative effect by the introduction of brilliant metallic surfaces and the juxtaposition of rich color tones, others have aimed at minute and painfully elaborated compositions, fine and delicate as a miniature on parchment or ivory. The chief Dutch painters of still-life are J. Brueghel the elder, Snyders, Leghers, the de Heem family, A. van Beijeren, W. Kalf, Heda, W. van Aelft, Dou, Fyt, etc. In the 19th century a great revival took place in this class of art. In France it was practised successfully by Robie, Vollon, and Ph. Rousseau; in Germany by Preyer of Düsseldorf; Hoquet of Berlin; P. Meyerheim, Hertel, Th. and R. Grönland, and by the woman painters Begas-Parmentier, H. von Preuschen, Hormuth-Kallmorgan, Hedinger, etc. The still-life of flowers and fruit is generally most successfully accomplished in water colors. The ancient Greek painter Pausias (q.v.) was especially skilful in the representation of flowers, while of another ancient artist it is said that the birds flew down and pecked at his picture of fruit. These were of course water color paintings, but not before oil painting reached its perfection in the Netherlands were flowers and fruit represented pictorially with absolutely realistic vividness.

Stillé, stĭl'ē, **Charles Janeway**, American educator and historian: b. Philadelphia, Pa., 23 Sept. 1819; d. 11 Aug. 1899. He was graduated from Yale in 1839 and was admitted to the bar, but abandoned this profession for literary pursuits. In the Civil War he was a member of the United States Sanitary Commission, and in 1866 was made professor of history and English literature in the University of Pennsylvania. He was chosen provost there in 1868 and held that office until 1880. He published 'Historical Development of American Civilization'; 'History of the United States Sanitary Commission' (1866); 'Studies in Mediæval History' (1882); 'Beaumarchais and the Lost Milton' (1886); etc.

Stillman, stĭl'man, **Thomas Bliss**, American chemical engineer: b. Plainfield, N. J., 24 May 1852. He was graduated from Rutgers College in 1873 and went to Germany to study engineering. After returning to the United States he was appointed instructor of analytical chemistry at Stevens Institute 1874–6, and was made professor there 1881–6. In 1884 he was state oil inspector for New Jersey. He was editor of the 'Stevens Institute Indicator' 1895–8 and has published 'The Rutgers Scarlet Letter' (1873); 'Engineering Chemistry' (1897).

Stillman, William James, American author: b. Schenectady, N. Y., 1 June 1828: d. Surrey, England, 6 July 1901. After graduation from Union College (1848) he studied landscape art with F. E. Church, in 1849 went to England to continue his art-work, adopted the views of Rossetti and Millais, whence he was styled "the American Pre-Raphaelite," and having returned to the United States began exhibiting at the Academy of Design, of which in 1854 he was made an associate. In 1852 he went for Louis Kossuth to Hungary to secure the crown-jewels which had been secreted by Kossuth at some point on the Danube. After some further study with Yvon at Paris, he came back to found with John Durand, the 'Crayon,' a magazine of art criticism, which continued two years (1855–7). In 1859 he was again in England, in 1861–5 was United States consul at Rome, and in 1865–9 held a similar post in Crete. Having abandoned art, owing to failing eyesight, he was a special correspondent for the *Times* of London from 1878 to 1898, traveling widely about the Continent, and being from 1886 correspondent for Italy and Greece. In 1883–5 he contributed critical papers on art subjects to the New York *Evening Post.* An expert photographer, he was at one time associate editor of the 'Photographic Times,' made for the Hellenic Society of London a valuable series of photographs of the Acropolis at Athens, and published (1872–3) two manuals of photography. As a journalist he wrote much on many subjects, chiefly art, history, and politics, and gained a considerable reputation. His best picture is 'The Procession of the Pines' (1858). Among his published volumes are: 'History of the Cretan Insurrection' (1874); 'Herzegovina and the Late Uprising' (1877); 'On the Track of Ulysses' (1887); 'The Union of Italy' (1898); 'The Old Rome and the New' (1898); 'Francesco Crispi' (1899); and an interesting 'Autobiography' (1901, first printed in the 'Atlantic' 1900). See this work.

Stillwater, stĭl'wâ"tėr, Minn., city, county-seat of Washington County; on Saint Croix River, 30 miles from its junction with the Mississippi River, and on the Chicago, M. & St. P., the Northern Pacific, and the Chicago

Digitized by Google

St. P., M. & O. R.R.'s; about 18 miles northeast of Saint Paul. It has steamer connections with the river ports, and regular connection with Dubuque and Saint Louis. It was settled in 1840 by Jacob Fisher and Calvin Leach, and was incorporated as a city in 1854. The Saint Croix River boom, through which pass each year about 300,000,000 feet of pine logs, is north of and near the city. Stillwater is in an agricultural region, and is extensively engaged in manufacturing. The chief industrial establishments are flour and feed mills, grain elevators, lumber mills, foundries, machine shops, carriage and wagon works, and furniture factories. The government census of 1909 gives the number of manufacturing establishments 38; the amount of capital invested, $3,277,000; the number of employees in manufactories, 857; the total amount of wages, $581,000; and the value of the product, $2,686,000. The city has a large trade in logs, lumber and lumber products, wheat, flour, and live-stock. It is the commercial and industrial centre of the Saint Croix lumber region in Minnesota and Wisconsin. The educational institutions are a high school, public and parish elementary schools, private business schools, and the Carnegie Library. The two banks have a combined capital of $200,000; the value of the business transacted annually is about $10,000,000. The government is vested in a mayor and council of nine members, three of whom are elected each year. Stillwater was first located on the plain bordering on Lake Saint Croix, with bluffs outside the settled portion. Now the old part of the city is given up to trade and manufacturing houses and the residential portion is on the bluffs. Pop. (1890) 11,260; (1900) 12,318; (1910) 10,198.

Stillwater, Battles of. See SARATOGA, BATTLES OF.

Stil'son, Daniel Chapman, American inventor: b. Durham, N. H., 25 March 1830; d. Somerville, Mass., 21 Aug. 1899. A machinist in the Charleston navy yard, when the Civil War broke out, he was appointed 3d assistant engineer in the Union navy and served until August 1862, when he resigned. He was reappointed a year later, and served to the end of the war, when he returned to his trade of machinist. He invented a wrench in wide use among mechanics, and safety fire-sprinkling apparatus.

Stilt, or Frost-bird. See SANDPIPER.

Stilted Arch, in architecture, an arch which does not spring immediately from the imposts, but from a vertical piece of masonry resting on them, so as to give the arch an appearance of being on stilts. Arches of this kind occur frequently in all the mediæval styles.

Stilts, wooden poles with steps or foot supports at a sufficient distance from the ground to allow a person standing on the steps to walk with long strides. Stilts are very useful in marsh lands and were formerly very popular in the French Landes (q.v.). In various European countries stilts are used by the peasants for crossing streams.

Stim'son, Frederic Jesup, American lawyer and author, known also by the pen-name "J. G. of Dale": b. Dedham, Mass., 20 July 1855. Graduated from Harvard in 1876 and from the law school of the institution in 1878, he entered practice in Massachusetts and was assistant attorney-general of that State in 1884–5. He was secretary to the National Conference on the uniformity of law in 1892; was made counsel to the United States Industrial Commission, and lectured at Harvard on legislation. He published 'Stimson's Law Glossary'; 'American Statute Law'; 'Handbook to the Labor Law of the United States' (1896); 'Labor in its Relation to Law' (1896); and in fiction, among several other works, 'Guerndale' (1882); 'The Crime of Henry Vane' (1883); 'The Residuary Legatee' (1887); 'First Harvest' (1889); 'King Noanett' (1896); and 'Jethro Bacon of Sandwich' (1901.)

Stimson, Henry Albert, American Congregational clergyman: b. New York 28 Sept. 1842. He was graduated from Yale in 1865, and studied in the Union and the Andover Theological Seminaries. He has held pastorates in several American cities, the latest being in New York; is a lecturer at the Chicago Theological Seminary; and has published 'Religion and Business' (1894); 'Questions of Modern Inquiry' (1894); and 'The Apostles' Creed' (1899.)

Stimson, John Ward, American artist: b. Paterson, N. J., 16 Dec. 1850. He was graduated from Yale in 1872, and from the Ecole des Beaux Arts, Paris. He became lecturer and art teacher at Princeton University, and was for four years director of the art schools of the Metropolitan Museum of Art, New York. He founded the Artist-Artisan Institute, New York, 1888, and later became director of the Art and Science Institution, Trenton, N. J. He is a popular lecturer on art, and has published 'The Law of Three Primaries'; 'Principles of Vital Art Education'; 'The Gate Beautiful'; 'Wandering Chords'; etc.

Stimson, Lewis Atterbury, American surgeon: b. Paterson, N. J., 1844. He was graduated from Yale University in 1863 and received the degree of M.D. from the same institution in 1874. He served as captain in the Union army during the Civil War. In 1893 he was a regent of the University of the State of New York, and is professor of surgery in Cornell University (1904). He has published: 'Operative Surgery' (1900); 'Fractures and Dislocations' (1900).

Stim'ulants, agents which temporarily increase the vital activities, either in particular organs and functions or in the whole physical organism. They are among the most valuable and important of medicines, and perhaps are more often the direct means of saving life than any others. But as they are powerful, their injurious effects when misapplied have been even more prejudicial to mankind than their best use has been beneficial. In fact it may be said that the abuse of this class of medicines, under the names of cardiacs, cordials, alexipharmics, etc., caused more deaths during the dark ages of medicine than did sword and pestilence united. The dreadful mortality of smallpox and fevers during the Middle Ages, and even as far down as the earlier parts of the 19th century, were mainly owing to the administration of heating stimulants, the tendency of which was to increase the violence of the disease, although they were intended merely to expel noxious and poisonous humors. But a more cautious use of these articles has been learned whereby they are the

Digitized by Google

constant means of preserving life. Stimulants are either simple and direct in their operation, as the external application of heat in all forms, dry and moist, by friction, etc.; the application to the stomach of hot liquors, spices, camphor, hartshorn, warm and aromatic gums and oils, as mint, cardamom, cajeput, ginger, asafœtida, red pepper, spirits of turpentine, etc.; or they act first as stimulants, but produce afterward effects of a different character, as is the case with wine, brandy, and spirits of all sorts; opium, ammonia, ethers, etc., all of which are highly stimulant at first, and in small quantity, but afterward, and when taken in larger doses, produce exhaustion, debility, sleep, and death. The first class are upon the whole the safer, and should be always used in preference to the last when they can be had, in all cases of suspended animation from cold, drowning, suffocation, etc.; while the others are more valuable for their secondary and remote effects, by means of which they ease pain, and relieve spasm, and other affections; and for these purposes they should be used freely, as they can do no hurt while the violence of the disease persists. But they should never be resorted to unless pain is urgent, or debility become so great as to endanger life.

Stiness, John Henry, American jurist: b. Providence, R. I., 9 Aug. 1840. He graduated at Brown University in 1876; studied law, admitted to the Providence bar and was appointed judge of the supreme court of Rhode Island 1893. He has written ‹History of Lotteries in Rhode Island› and ‹Liquor Legislation in Rhode Island.›

Sting, a weapon possessed by many plants and small animals, in various forms, employed to pierce and in most cases also to poison, the flesh of animals to be killed for food, or from which injury is received or expected. In plants this office is performed by stiff, sharp, hollow hairs emitting an acrid juice. (See NETTLE.) Such stinging-hairs sometimes cause extreme irritation in the skin and mucous membranes of even the largest animals, and hence cause the plants to be avoided, thus protecting the species against harm.

The simpler marine animals (Cœlenterates) are widely defended by stinging instruments, consisting of coiled poison-carrying threads which dart from microscopic capsules in the surfaces of the integument. See NEMATOCYST; JELLY-FISH.

Insects are plentifully provided with piercing weapons. These in some cases are mouth-parts and in others are modified ovipositors. To the first class belong the sharp prolonged jaws, many plant-sucking bugs, or blood-sucking ones, such as the bed-bug, cone-nose (qq.v.) and others. In another group are found the gnats, mosquitoes, etc., which inflict pain upon large creatures and death upon minute ones by stabbing with their complicated beaks, which consist of a bundle of lancets and saws. (See MOSQUITO.) Many caterpillars are defended by nettle-like hairs, each of which is a specially modified spine, and able to inflict so great annoyance that hairy caterpillars generally are studiously avoided by most animals. The «sting,» properly speaking, however, is found among insects only in the hymenoptera, as bees and wasps, where it is a modified ovipositor (q.v.). In wasps (q.v.) it serves a special purpose in paralyzing the insects stowed away alive with the eggs in the nest-cells. Spiders are said to «sting,» but in reality they bite, in some cases poison. Scorpions, however, possess what is properly enough termed a sting in the pointed telson or tail-piece appended to the extremity of the abdomen, with which a poison-infected puncture is inflicted (see SCORPION). Some fishes, as the sticklebacks, surgeon-fish, and notably the sting-rays (q.v.), have certain defensive spines, by which highly irritating wounds may be inflicted. The use of the fangs by poisonous snakes, also is often spoken of as a stinging.

Sting-ray, a fish-ray of the family *Trygonidæ* remarkable for the long, flexible, whip-like tail, which is armed near its root with an erectile spine or spines, very sharp at the point, and furnished along both edges with sharp cutting teeth. See RAY.

Stink-bug, any of several small heteropterous plant-feeding bugs, allied to the squash-bugs, which emit a vile odor.

Stink-horn Fungus. See FUNGI.

Stink-pot, a malodorous kind of box-turtle (q.v.).

Stinking May-weed. See DOG'S-FENNEL.

Stinkwood, a tree (*Oreodaphne fœtida*) of the order *Lauraceæ,* a native of the Cape of Good Hope, remarkable for the strong disagreeable smell of its wood, which, however, is hard, very durable, takes an excellent polish, and resembles walnut. It has been used in shipbuilding.

Stint. See SANDPIPER.

Sti'pa, feather-grass; an important genus of grasses (q.v.).

Sti'pend, a payment at stated periods for services rendered, and generally used in connection with official or ecclesiastical salaries. It is not officially used, however, except in Scotland, where the provision for the support of the parochial minister of the established church is designated as a stipend.

Stipen'diaries. See MERCENARIES.

Stipple Engraving. See ENGRAVING.

Stip'ules, in botany, are organs connected with the leaves, existing only in the dicotyledonous plants, though not always present. They are small scale-like or leafy appendages at the point where the leaves come off from the stem. and are commonly in pairs, there being one on each side of the petiole, as in the hornbeam and lime. They are more frequently free, not being attached to the petiole; but at other times they are united to the base of that organ, as in the genus *Rosa.* The stipules afford excellent characters for the arrangement of plants. When a vegetable of a natural order has these organs, it is very seldom the case that all the others are not equally provided with them. Thus they exist in all plants of the natural orders *Leguminosæ, Rosaceæ, Tiliaceæ,* etc. As they fall off very easily when they are free, their absence might sometimes induce one to suppose a plant destitute of them, but this error may be avoided by observing that they always leave on the stem, at the place where they are attached, a small cicatrix, which attests the fact of their having existed. They vary greatly in their nature and consistence; thus they may be foliaceous or leaf-

Digitized by Google

like, as in the common agrimony; membranous, as in the fig and magnolia; spinescent or thorny, as in the jujube and gooseberry. Some fall off before the leaves, as in the common fig and the lime; others are merely deciduous, or fall at the same time as the leaves; and there are others which continue for a longer or shorter time after the leaves have fallen, as in the jujube, gooseberry, etc. The use of the stipules appears to be to protect the leaves before their expansion, as is evidently shown by their relative disposition in the buds of some orders of plants. See LEAVES.

Stirling, stėr'ling, **James Hutchinson,** Scottish philosopher: b. Glasgow 22 June 1820. He was educated in arts and medicine in Glasgow University, France, and Germany; practised as a surgeon in Wales for some years, but ultimately devoted himself to literary and philosophical studies. He is the author of 'The Secret of Hegel' (1865); 'Sir Wm. Hamilton, being the Philosophy of Perception' (1865); 'Jerrold, Tennyson, Macaulay, and other Essays' (1868); 'As Regards Protoplasm' (1869); 'The Philosophy of Law' (1873); 'Burns in Drama, together with Saved Leaves' (1878); 'The Community of Property' (1885); 'Philosophy and Theology' (the Gifford Lectures, 1890); and translator of Schwegler's 'History of Philosophy,' and Kant's 'Critique of Pure Reason in his Text-book to Kant.'

Stirling, William Alexander, EARL OF, Scottish poet and colonial proprietor: b. about 1567; d. London 12 Sept. 1640. He was educated at Glasgow and in Germany. His tragedy 'Darius' was published in 1603, and was followed by three others, 'Crœsus'; 'The Alexandrian Tragedy,' and 'Julius Cæsar,' which were collected under the title, the 'Monarchicke Tragedies,' in 1607. He also wrote a number of sonnets, but is best known as a recipient from James I. of a grant bestowing upon him, under the name of Nova Scotia, the whole of the eastern portion of Canada, and the patent of sole printer for 31 years of King James' version of the Psalms. The conquests of France in Canada, however, deprived him of practically all of his grant. Consult: Charles Rogers, 'Memorials of the Earl of Stirling and the House of Alexander' (1877).

Stirling, Scotland, (1) county-seat of Stirlingshire, on the south side of the Forth, 29 miles northeast of Glasgow. It occupies a commanding site, Castle Hill, resembling its namesake at Edinburgh. The castle is of great historical interest. It contains the rooms where Douglas received a mortal stab from James II., who, as well as James V. was born in this castle; the Parliament-house, chapel-royal, etc. The view from the battlements comprehends many of the lochs and fertile vales of Scotland, the winding river and the Grampian and Ochil hills, together with the ruins of Cambus-Kenneth Abbey and the Bridge of Allan. Within the town, Greyfriars church, begun by James IV., museum, library, picture-gallery, several ancient mansions and monuments deserve notice. The manufactures include, woolen goods, carpets, leather, ropes and carriages. The salmon-fisheries are profitable. There is little trade. Pop. about 20,000. (2) Stirlingshire is a county of South Scotland with an area of about 466 square miles. About one third of the county is hilly, and rises in Ben Lomond to a height of about 3,000 feet. Here the Forth flows into the Firth of Forth, coming from Ben Lomond. The southeastern portion is traversed by the Forth-Clyde canal. The famous Loch Katrine forms one of the numerous lochs or lakes. The valleys and plains are exceedingly fertile and highly cultivated — there are a few marshy lands. The county is rich in minerals, especially iron and coal. The chief industries are the working of the mines, and wool, cotton and linen factories. The chief towns besides the capital, are Falkirk, Grangemouth, and Kilsith.

Stirling's Plantation on Bayou Fordoche, Engagement at. On 5 Sept. 1863, Gen. Herron's division of the Thirteenth corps, Gen. Banks' army, embarked on transports at Carrollton, La., and sailed up the Mississippi to disperse a Confederate force under Gen. R. Taylor, which was then on the west side, below the mouth of Red River, seriously threatening the navigation of the river. It arrived at Morgan's Bend on the 7th, from which point, on the morning of the 8th, about 200 cavalry and a brigade of infantry, under Col. H. M. Day, moved out on a reconnoissance toward the Atchafalaya River, and encountering the Confederate pickets, drove them across the Atchafalaya and then fell back three miles. On the 9th Day was joined by Gen. Herron, with another brigade, and a second reconnoissance was made to the Atchafalaya, where there was a smart skirmish, and Herron fell back to the river, with a loss of a few men killed and wounded. On the 12th the cavalry was again sent to the front to feel the enemy, and the 19th Iowa, 26th Indiana, and two guns were sent out seven miles to the vicinity of Atchafalaya Bayou to picket the country and support the cavalry. All were under command of Lieut-Col. J. B. Leake, of the 20th Iowa. Leake had a skirmish with the enemy and fell back to Stirling's Plantation, on Bayou Fordoche, about six miles from Morganza, from which point he sent out parties daily, which skirmished with the Confederates. On the night of the 28th Gen. Thomas Green, with two brigades of Confederate infantry, one of cavalry and mounted infantry, and a battery, crossed the Atchafalaya, and by different routes reached the rear and flanks of Leake's command, by marching through swamps and canebrakes, and about noon of the 19th fell upon his unsuspecting camp. The cavalry was soon driven from the field, and managed to escape with small loss; the infantry made a gallant stand and fought desperately, but attacked on all sides, were soon overpowered and captured, with the two guns. Leake was severely wounded. The Union loss was 16 killed, 45 wounded, and 454 missing or captured; the Confederate loss, 26 killed, and 85 wounded. Consult 'Official Records,' Vol. XXVI.

E. A. CARMAN.

Stir'rup, an article of equestrian equipment with which the ancients were not acquainted. The Roman youth were accustomed to leap upon their horses sword or lance in hand. Distinguished persons and old men had servants to place them on their horses, and conquered sovereigns were often compelled to perform this office for their vanquishers.

Stitchwort, plants of the genus *Alsine*, belonging to the pink family, *A.* (*Stellaria*)

Digitized by Google

holostea, most properly bears the name. It is an Old World species, an erect, but low, hardy perennial, with slender stems and opposite grass-like leaves, which are sessile and usually glabrous. The flowers are five-merous, the petals deeply cleft, and are showy, being three fourths of an inch wide and very numerous. They are gathered in leafy panicles and fairly cover the plants with bloom. For this reason stitchwort is cultivated as a border plant. It was reputed to be a cure for a «stitch in the side» and even for snake-bites. It has many other names, as shirt-buttons, allbone, and snap-jack, the latter referring to its brittle nodes.

Stith, William, American historian: b. Virginia 1689; d. Williamsburg, Va., 27 Sept. 1755. He studied theology, was ordained in England to the ministry of the Established Church, was chaplain of the Virginia house of burgesses, and in 1752–5 rector of Henrico parish and president of William and Mary College. He published a 'History of the First Discovery and Settlement of Virginia' (1747), which De Tocqueville criticised as «long and diffuse,» but is nevertheless a standard work on early Virginian history, and written with excellent scholarship. It was the only published instalment of an extended work planned by the author, and reaches as far as the dissolution of the London Company. It is prepared from the colonial archives, Sir John Randolph's papers, the 'Records' of the London Company, and the Byrd library.

Sti'ver, a former Dutch coin and money of account worth about two cents.

Stoat, the British name of the common European weasel (q.v.).

Stobæus, Johannes, Greek grammarian and critic: b. Stobi, Macedonia, about 500 A.D. For the education and improvement of his son Septimius, he compiled a florilegium of Greek literature, for which he drew upon about 500 Greek poets, historians, philosophers, etc. This has formed one of the most precious legacies which ancient scholarship has bequeathed to posterity. His works contain citations and quotations from many lost works and have been of immense assistance to modern Greek criticism. The original work was composed under the single title 'Anthologion,' but the scholars of the Middle Ages divided it into two parts 'Eclogæ Physicæ et Ethicæ' and 'Florilegium,' which were edited by Gaisford and published at Oxford, the former in 1825; the latter in 1850.

Stock, a popular name for several species of cruciferous flowering plants long favorites in gardens. The Virginian stock (*Malcomia maritima*) is a hardy annual herb which grows wild in the Mediterranean region. It is of simplest culture and will thrive well in cities without apparently impairing its beauty or fragrance. The common autumnal queen, or Brompton stock (*Matthiola incana*) is a biennial or perennial semi-woody herb or sub-shrub, a native of the Mediterranean region and the Isle of Wight. The intermediate or ten-weeks stock (*M. incana,* var. *annua*) is considered by some botanists to be a distinct species, but except for its annual habit it differs little from the preceding and is therefore ranked as a variety. Both are known as gilliflower or gellyflower and are widely cultivated for their variously colored deliciously fragrant flowers which in many varieties are double. The latter usually are sown very early and successionally so as to occupy the early summer months with bloom; the former are planted somewhat later so as to continue the blossoming into the autumn. They are about as easy to grow as geraniums and require fairly rich friable garden soil, good drainage, but plenty of moisture, and clean cultivation. There are about 30 other species, some of which are cultivated and several of which are fragrant only at night.

Stock, in law, represents the capital of corporations and is usually divided into shares of a definite value denoting the rights in the assets, profits, and management of the company. A certificate of stock is a mere evidence that the person therein designated is entitled to an interest in the company, which is stated. Stock may be divided into several classes, for example. as common and preferred; holders of the common stock have an equal right in the company and its profits; holders of the preferred stock are entitled to a preference over other shareholders but they are not creditors of the corporation. Dividends on stock represent a division of the surplus or net profits arising from the business of the company. Stock is considered as personal property and may be transferred at the will of the owner by proper assignment of the certificate.

Stock-dove, a wild European pigeon (*Columba œnas*), about 13 inches in length, and with a general bluish-gray plumage, the breast being purplish. It raises two or three broods in a season, and builds its nest in the hole of a tree, in a rabbit-burrow, or some similar place. See PIGEON.

Stock Exchange. See EXCHANGE.

Stock Feeding. See NUTRITION OF FARM ANIMALS; PASTURE; SILAGE; SOILING, and similar titles.

Stock Jobbing. See EXCHANGE.

Stock Raising. The New England settlers owned but limited tracts of land with small clearings in the timber and they maintained live stock, not so much as a means of gain as of service to the family. A «team» of horses, or «yoke» of oxen for work; two or three cows for milk, butter, and cheese; some sheep to provide wool for knitting and weaving, and a few pigs — this was the extent of the live stock on the farms at this period of American agriculture. Moving westward much the same conditions obtained until the timber regions west of the Alleghanies were reached and passed; but with the settlement of fertile river valleys and particularly the conquest of the boundless prairies of the great West a new order of live stock husbandry was inaugurated.

In America the pig has been co-extensive with the greatest of food crops, Indian corn. The rich agricultural lands of southeastern Pennsylvania gave bountiful yields of this crop and here developed in and about Chester County the first truly American breed, since known as the Chester White. The Miami Valley in Ohio was the next point westward at which this crop flourished exceptionally well, and here was developed in the sixties and later the Poland

Digitized by Google

China, which may be truly called the real American hog. In these days the Miami Valley was the great corn and hog centre of the world, and Cincinnati, the market point, was facetiously called «Porkopolis.» Chicago was not yet known as a live stock centre, but as the great prairies were opened up a sudden and substantial transformation took place in live-stock husbandry; the bison was exterminated and grass grew abundantly on what had been his feeding grounds; Indian corn here first found ideal conditions and it spread rapidly westward as far as the arid plains; the pig joined the steer and both followed this crop to the limits of the corn belt. The steer went on alone beyond the corn belt over the arid regions and as far as grazing lands were found, even to the foot-hills of the Rockies. On these Western plains men counted their cattle by the thousands. Grass and range were free and the cattle were grazed to market, starting in Texas, perhaps, and feeding all the way to Omaha, Kansas City, or even Chicago. The only expense was herding, and the only losses were from storms, and from wolves grown savage because of scarcity of food due to the extermination of the bison. Gradually by encroachment of settlers from the East, the free grazing to these markets was cut off and latterly the range business has been confined to the production of feeders to be shipped eastward and finished in the corn belt. By 1900 the free range even in the West was at an end, much of the land was fenced, and at least a nominal rental was exacted.

With the rapid shrinkage of grazing lands, nothing was more natural than that they should become greatly over-stocked. With the limited rainfall of the region pastures had little recuperative power. Some of the better grasses were crowded out and the grazing rapidly deteriorated. Sheep followed cattle in many places, gnawing the last vestiges of grass to the surface, and not infrequently these were followed by goats to live on the cactus and whatever else remained above ground, and by hogs to dig out what might be found beneath the surface. In this way many of the grazing lands, especially in the Southwest, became practically ruined; but the disaster suggested the remedy, and intelligent measures are already (1903) being taken to re-stock these ranges with the native grasses. In the Northwest, with less heat and more moisture, pasture fared better, and Montana and the Dakotas have continued to produce both cattle and sheep in immense numbers, both industries extending far into the great Canadian Northwest. Both cattle and sheep have the habit of moving slowly with the storm until a sheltered place is reached in some ravine, where they huddle together only to be snowed under. It is, therefore, a death trap in a Dakota blizzard and the losses in this way are heavy. Horses behave differently and will keep moving. The consequence is that, in many localities cut by ravines cattle and sheep have given place to horses, and in these regions the production of these animals is as much a range industry as ever was that of cattle.

All this operated to make the range of the far West, where only grass grew, the producing ground, and the eastern prairies or the corn belt the finishing ground, for what has developed into the most gigantic live-stock industry ever known. The breeding herds supplying sires

TOTAL RECEIPTS OF STOCK FOR 38 YEARS AT THE UNION STOCK YARDS, CHICAGO.

	Cattle	Calves	Hogs	Sheep	Horses
1873	761,428	....	4,437,750	291,734	20,289
1874	843,943	....	4,258,379	333,655	17,588
1875	920,866	....	3,912,110	418,948	11,346
1876	1,096,745	....	4,190,006	364,095	8,159
1877	1,033,151	....	4,025,970	310,240	7,874
1878	1,083,068	....	6,339,654	310,420	9,415
1879	1,215,732	....	6,448,330	325,119	10,473
1880	1,382,477	....	7,059,555	335,810	10,398
1881	1,498,550	48,948	6,474,844	493,624	12,909
1882	1,582,530	24,965	5,817,504	628,887	13,856
1883	1,878,944	30,223	5,640,625	749,917	15,255
1884	1,817,697	52,353	5,351,967	801,630	18,602
1885	1,905,518	58,500	6,937,535	1,003,598	19,356
1886	1,963,900	51,290	6,718,761	1,008,790	27,599
1887	2,382,008	65,859	5,470,852	1,360,862	46,404
1888	2,611,543	96,086	4,921,712	1,515,014	55,333
1889	3,023,281	122,968	5,998,526	1,832,469	79,926
1890	3,484,280	175,025	7,663,829	2,182,667	101,566
1891	3,250,359	205,383	8,600,805	2,153,537	94,396
1892	3,571,796	197,576	7,714,435	2,145,079	86,998
1893	3,133,406	210,557	6,057,278	3,031,174	82,492
1894	2,974,363	160,949	7,483,228	3,099,725	97,415
1895	2,588,558	168,740	7,885,283	3,406,739	113,193
1896	2,600,476	138,337	7,659,472	3,590,655	105,978
1897	2,554,924	122,976	8,363,724	3,606,640	111,601
1898	2,480,897	132,733	8,817,114	3,589,439	118,754
1899	2,514,446	136,676	8,177,870	3,682,832	111,611
1900	2,729,046	136,310	8,109,064	3,548,885	99,010
1901	3,031,396	181,824	8,290,494	4,044,095	109,353
1902	2,941,559	251,747	7,895,238	4,515,716	102,100
1903	3,704,229	....	7,325,923	4,582,760	....
1904	3,526,684	....	7,238,746	4,504,630	....
1905	3,791,304	....	7,725,738	4,736,558	....
1906	3,742,519	....	7,816,485	4,805,449	....
1907	3,727,248	....	7,715,903	4,218,115	....
1908	3,460,877	....	8,660,721	4,351,889	....
1909	3,342,427	....	7,033,647	4,441,471	....
1910	3,555,026	....	5,924,502	5,228,643	....

* Including calves.

Digitized by Google

have been located mostly in the corn belt, and these two great regions have worked well together, each supplying what the other lacks. The western range had cheap grass, but neither corn to finish nor shelter to protect. The corn States had abundance of the cheapest of grains and all conditions were ideal for the production of the best of breeding stock.

Chicago, Omaha, and Kansas City became the market centres for this immense industry, the magnitude and growth of which can be best realized by consulting the preceding table, showing the number of animals marketed at the Chicago Stock Yards for the last 37 years, as given in the report of the Stock Yards Company for 1902.

The Chicago Stock Yards, with their 500 acres of yarding, 13,000 pens, 25 miles of streets, and 300 miles of railroad track, is the largest live-stock market of the world, but Omaha and Kansas City are respectable seconds, and all together mark a development in live-stock husbandry beyond the expectations of even the most sanguine of the early stockmen.

The problems on the range have been those of grass, water, and safety from blizzards. The problems in the corn belt have been the methods of feeding and finishing. These problems will all change and very speedily. Live-stock will be produced and finished in both places, and the question now is what to produce and how? The range can finish sheep and many classes of horses and it is now able to put a fairly good steer directly on the market. The cost of transportation is becoming so great that the corn farmer is feeling the need of producing his own cattle, but how to do it on his high-priced lands is a problem that he is busily engaged in solving. Whether he will succeed in producing meats successfully is a matter of opinion as yet, but those who have studied the question most thoroughly agree that it must be done.

The dairy industry is independent of range conditions, because from the nature of the case it must be carried on near the principal centres of population. The consumption of milk and cream in our large cities has increased to such an extent as to exhaust the dairy output for a radius of many miles. Milk is shipped more than 100 miles into Chicago every day, and over 300 miles into New York.

Relatively speaking, the wool industry has declined in America coincident with its development in Australia. The prairie section is distinctively a meat-producing region, and all other forms of live-stock industry are secondary and supplemental to this chief enterprise.

With the passing years the question of fertility is certain to engage the attention of all thoughtful farmers, even on the best producing lands. It is true even now in the very opening days of the century, and with this will come naturally more settled policies regarding live-stock husbandry. Animals will be raised not merely for their own sake but as a means of consuming the product of the land, and more and more will rotations be based upon considerations touching the maintenance of fertility. It is well known now that the nitrogen supply of all lands rapidly runs down under cultivation. It is equally certain that the farmer cannot afford to buy it back for ordinary crop production at the current rate of 15 cents per pound, even if the world's needs could be me by the visible supply, which is impossible. The only feasible method of maintaining the nitrogen supply of agricultural lands is by the growth of leguminous crops, through whose agency nitrogen can be secured direct from the atmosphere at an expense not above one cent per pound. Only animals can consume leguminous crops, however, and this fact is certain to exert a controlling influence in the future on live-stock industry. Leguminous crops and live-stock go naturally together and both are destined to play an important role in the future development of American agriculture.

EUGENE DAVENPORT,
Dean of the College of Agriculture, University of Illinois.

Stock Yard. See ABATTOIR; PACKING INDUSTRY.

Stockade', (1) In civil engineering, a row of piles, or a series of rows, driven into a sea or river shore, to prevent the erosion of the banks. (2) In fortification, stout timbers planted in the ground so as to touch each other, and loop-holed for musketry. In its most effective form it is eight or nine feet high, has a ditch in front and a banquette in the rear. See FORTIFICATION.

Stockbridge, stŏk'brĭj, Mass., town, Berkshire County; on the Housatonic River, and on the New York, New Haven & Hartford railroad; 15 miles south of Pittsfield. The town includes the villages of Stockbridge, West Stockbridge, Centre, Curtisville, and Glendale. In 1736 the Stockbridge Indian mission was moved here from Great Barrington, and under the influence of this mission the Indians were civilized and Christianized, to that, in 1739, when the town was incorporated they were given full privileges of citizenship. In 1751 Jonathan Edwards became pastor of the church. After the Revolutionary War the Indians moved west, finally settling in Kansas. The town is situated in the midst of picturesque mountain scenery, and contains many handsome summer residences. It has a number of mills, including woolen, paper, grist and saw mills; and a national bank with a capital of $200,000. It has a public high school, founded in 1868 and a public library, founded in 1862. Pop. (1910) 1,933.

Stöcker, stĕk'ĕr, Adolf, German theologian and social reformer: b. Halberstadt 11 Dec. 1835. After studying theology and philology in Halle and Berlin, he was made pastor at Seggerde (1863) and eventuallv court and cathedral preacher at Berlin. His principal importance is owing to the fact that in opposition to the Social-Democrats he founded, in 1877, a Christian Socialistic party. This new association won numerous adherents in only a few places, but the idea of Christian Socialism has been widely accepted by a large number of religious teachers. In his fiery zeal and activity against his opponents he was particularly violent in his treatment of the Jews, and he thus hindered the practical success of his theory. In 1880 he was elected to the Reichstag and allied himself with the extreme conservatives. But his socialistic activity, by which he was led more and more to take the attitude of a reforming agitator displeased the government and in 1890 he was dismissed from his office as court-preacher. He is presi-

Digitized by Google

dent of the Berlin City Mission; Member of the Upper Synod; and in 1892 became editor of the 'Deutsche Evangelische Kirchenzeitung.' He is the author of a volume of 'Sermons for the People' as well as of 'Speeches.' He has also published many Socialistic tracts.

Stockholders. A stockholder is one who owns stock in a corporation or joint stock company, and who has been vested with certain rights and liabilities by law, by virtue of his relation to other owners of stock and to creditors of the corporation. The term shareholder is used commonly interchangeably with stockholder. When a corporation is formed and the books of the company are opened, individuals subscribe for stock or shares in the company and certificates are issued to them as evidence of their right in the company which is granted by virtue of the sale of stock, the certificates of stock being merely the evidence of the transaction. Loss of certificates, or the fact of their not being issued cannot relieve the owner of stock of his rights, or of his liabilities. Although stock may be paid for in services, or good will, or patents, or property, as well as in money or negotiable paper, the stockholders as soon as they acquire membership in the corporation stand on the same footing, and have equal privileges. The number of shares owned regulates the proportion of interest to be drawn by the individual, and the voting power in the affairs of the company. Any person who has legal capacity to own personal property may be a stockholder, and municipal and private corporations may be stockholders in other corporations within limitations contained in their incorporation. A manufacturing corporation may not subscribe to the stock of a bank or of a railroad, but may in payment of a debt, take stock in such other corporation, and may hold it and enjoy the same rights as other stockholders. The rights of all stockholders are represented by the corporate management, usually a board of directors. Legal relation between the corporate management and the shareholders is created by subscribing to, or contributing for shares of stock. The stockholder relies entirely upon the charter of the corporation as to his contract, regardless of representations of an agent, and an alteration in the constitution effecting a radical change in the corporate enterprise releases a shareholder from his subscription. A corporation has the right, through its management, to carry on the corporate enterprise as against all persons including a minority of the shareholders, in a manner and for the purposes set forth in its constitution. The board of directors can be controlled only by action of a majority of shareholders. It is understood that the majority of shareholders shall govern in all matters coming within the act of corporation, and all shareholders are bound by the acts of the majority represented by the management. The individual shareholder has only that control of the affairs of the corporation which his vote represents at the meetings of shareholders. If it may be shown that any act of the corporation will benefit a majority of shareholders, one shareholder or a minority, may not interfere, because the act may be an injury to him. But a minority may prevent by law any use of the funds of the corporation which are not strictly within the charter, or which may be shown as detrimental to the majority.

Shares of stock give the holder a fixed right in the division of the profits or earnings of the company so long as it exists, and of its effects when dissolved.

At corporate meetings each shareholder has a right to vote, and this cannot be taken from him. The right to vote by proxy does not exist unless so stated in the constitution of the company. The shareholder has the right to inspect the company books either personally or through a representative or attorney.

It is supposed that stock is paid for at par, and that the number of shares sold represents the working capital of the corporation. A creditor may enforce his right to have the nominal value of capital stock paid in, even to making the directors call upon the stockholders to pay a pro rata share on their stock.

The liability of a stockholder for the debts of the company is fixed by statute and differs in the various States. In some States a stockholder can be held for a sum equal to his subscription; special liabilities which make the stockholder responsible for other amounts or for particular debts, also exist under the laws of some of the States.

Regarding the liability of shareholders in a national bank, it has been held that the shareholders are individually responsible, equally and ratably, and not one for another, for all contracts, engagements and debts of such association to the extent of the amount of their stock therein, at the par value thereof, in addition to the amount invested in the shares.

Irregular or fraudulent transfers may be set aside if it can be shown that there was intention to escape liability to the detriment of creditors.

A subscriber to stock is presupposed to know the obligations assumed and ignorance will not excuse him from liability to creditors.

HENRY M. EARLE,
Attorney, New York.

Stockholm, stŏk'hōlm, Sweden, capital of the country on the Mälar See (Lake Mälar), 440 miles southwest of Saint Petersburg. It is picturesquely situated on a cluster of islands, connected with the mainland by bridges, chief of which are the Norrbro and Vasabro, joining the stadtin or city with the north side of the strait. The city, without its northern accessories, might impress one as another Venice, especially in approaching it from the Baltic or from Moseback Hill. Yet it surpasses in natural attractions the Venetian city. The largest island is Gustavsholm, containing the city proper, and with the islands of Riddarsholm and Helgeandsholm, is the oldest section. Its antiquity and irregularity render this part most interesting. Other islands contain the modern-constructed town. The houses are frequently coated with stucco in light colors or white. The buildings of note are the palace of the 17th century, with Corinthian pillars adorning the façade, and an edifice of symmetrical proportions. The oldest church is St. Nicholas (1264), in which Swedish sovereigns are crowned; the Riddarsholm Kyrka, contains the remains of a long line of kings and has other historical interest. In Norrmalm is the church of Adolphus Frederick and the National Library, containing 250,000 books,

Digitized by Google

and 8,000 MSS. On the northern mainland stands the National Museum, a fine Renaissance edifice, which contains many antiquities, coins, drawings, engravings, etc. There are, too, the governor's house, facing the quay where an obelisk commemorates Gustavus III.; the Ridderhus or Senate Chamber; the Rigsdagshus or House of Parliament; exchange, mint, town-house, with courts of law; ethnographical museum with numerous Scandinavian antiquities; theatres, opera-house, arsenal, and barracks. There is a medical college, technological institute, navigation school, school of design, etc., also benevolent institutions; literary, scientific and artistic associations, etc. Chief among the latter are the Swedish Academy, Academy of Sciences, celebrated by the name of Berzelius; musical academy; medical, horticultural and agricultural societies. Ship-Island, east of the city island, is headquarters of the Swedish navy, and contains ship-building yards, marine repair-shops, etc. Farther east are the islands containing the zoological gardens. All the islands have communication with each other by bridges, tramways, steamboats, etc. The recreation grounds and promenades are attractive, especially Djurgarden, Haga Park and Carlberg. The manufactures are chiefly textiles, porcelain, pottery, sugar, tobacco, cotton, ironware and machinery. Trade is considerable, and the principal exports are: iron, copper, tar and timber. The imports: colonial produce, wine, salt, fruit, etc. The shipping of Stockholm is second highest in the Kingdom. There were, in 1908, 249 vessels engaged, with a total tonnage of 124,037. Stockholm was founded in 1260. Subsequently fortified, it withstood several memorable sieges. Pop. about 320,000.

Stocking, a covering for the foot and leg, knitted or woven either from cotton, woolen or silk thread. The stocking is made usually only of one thread entwined so as to form a species of tissue, extremely elastic, which readily adapts itself to the part it is intended to cover. The tissue differs from cloth in having neither warp nor woof, but approaches it closely, and is much superior for the purposes to which it is applied. The ancients wore no particular covering for the legs, but during the Middle Ages, hose or leggings of cloth came into use; and at a later period the art of knitting stockings was invented, according to some authorities by the Spaniards, while some attribute it to the Scots. In 1589 William Lee of Nottinghamshire, England, invented the stocking-frame, a machine for weaving stockings which was in use and scarcely improved upon for nearly two centuries. Lee met with little encouragement in his attempts to set up an establishment in England, and went to France where he was received with great favor by Henry IV.; the monarch's assassination soon after, however, interrupted his prospects and he died in Paris in great poverty. A knowledge of his machine was carried back to England by some of his workmen who established themselves in Nottingham, which has since remained the principal seat of the English hosiery manufacture. For the stocking-frame and improvements in stocking machinery, and for modern methods of manufacture, see HOSIERY; KNITTING.

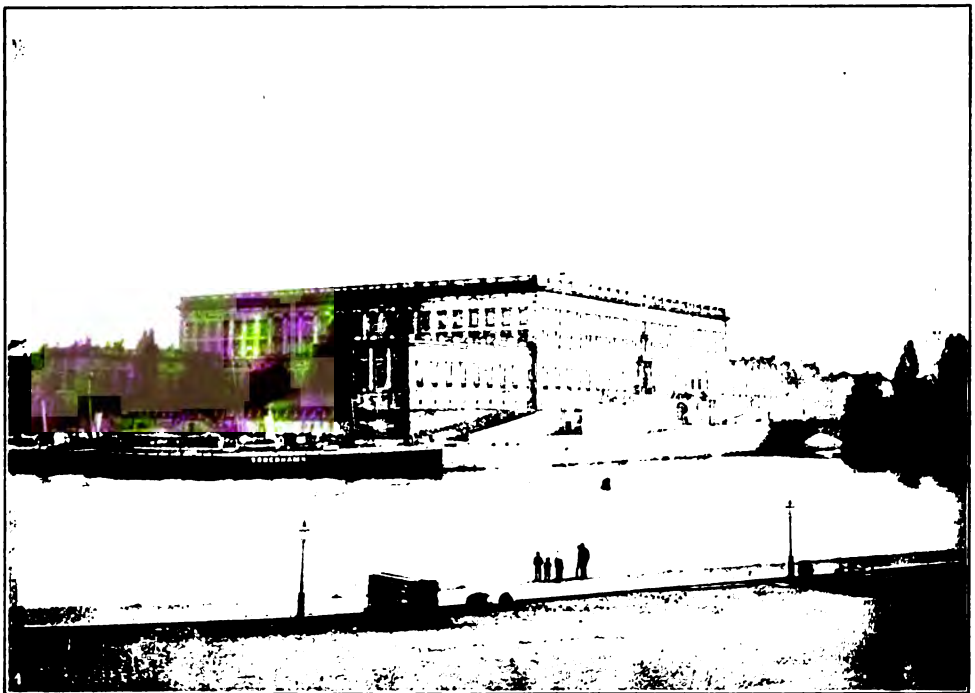
Stockport, stŏk'pōrt, **England**, in the counties of Cheshire and Lancashire, on the Mersey River, five miles southeast of Manchester. It stands upon an elevation, in terraces, is irregularly built, but highly picturesque. There are churches of various denominations, the chief of which are St. Mary's, St. Thomas', St. George's, St. Peter's, St. Paul's, and Christ Church. Other noteworthy buildings are the Mechanics' Institute, market-hall, free library, technical and grammar schools, and infirmary. The Museum is situated in Vernon Park. The railway viaduct on the London and North-Western Railroad is of fine proportions, and spans a great part of the town. The staple manufacture is cotton; there are numerous factories and industrial works — including print, dye and bleach works, and extensive hat factories, iron and brass foundaries, breweries and brick-yards. Pop. about 96,000.

Stocks, a wooden apparatus to put the legs of offenders in, formerly used for the restraining of disorderly persons, or as a punishment for certain offenses.

Stockton, stŏk'tŏn, **Francis Richard**, American author: b. Philadelphia, Pa., 5 April 1834; d. Washington, D. C., 20 April 1902. After a secondary education in Philadelphia, he became a wood-engraver, practised the art with some success, and invented a double graver (1866). In 1872 he entered journalism, joining the staff of the Philadelphia *Post*, in the same year that of 'Hearth and Home' of New York, somewhat later that of 'Scribner's Monthly,' and in 1874 that of 'St. Nicholas,' of which he was assistant editor until 1882. His first success was made with 'Rudder Grange' (1879), a burlesque account of a house-boat outing, and this he followed by the now well-known series of quaint and whimsical volumes which have made Stocktonian humor a thing peculiar to itself. Much of his best work is to be found in his short stories, the best known of which is probably 'The Lady or the Tiger.' From the list of his published works may be further cited the following titles: 'The Casting Away of Mrs. Lecks and Mrs. Aleshine' (1886); 'The Bee Man of Orn' (1887); 'The Dusantes' (1888); 'The Great War Syndicate' (1889); 'The Squirrel Inn' (1891); 'The Adventures of Captain Horn' (1895); 'A Story Teller's Pack' (1897); 'The Associate Hermits' (1898); 'A Bicycle of Cathay' (1900); 'John Gayther's Garden, and the Stories Told Therein' (1902); and 'The Captain's Toll-Gate' (1903).

Stockton, Richard, American statesman: b. near Princeton, N. J., 1 Oct. 1730; d. there 28 Feb. 1781. He was graduated at the college of New Jersey, at Newark, in 1748, studied law, was admitted to the bar in 1754, and rose rapidly to the first rank as a lawyer. In 1776 he visited England. He was made a member of the executive council of New Jersey in 1768, and in 1774 appointed a judge of the supreme court. In 1776 he was elected to Congress, and, though at first doubtful of its policy, cordially supported the Declaration of Independence. In the same year he served on the committee appointed to inspect the northern army and report its state to Congress, and after his return to New Jersey

Digitized by Google



1. The Royal Palace, Stockholm. 2. General View of Stockholm.

Digitized by Google

was captured by the British and confined in the common prison at New York. The unusual severity with which he was here treated broke down his strength, and eventually caused his death.

Stockton, Robert Field, American naval officer and politician: b. Princeton, N. J., 20 Aug. 1795; d. there 7 Oct. 1866. He served in the War of 1812 and in the Algerian war 1814–15; in 1821 commanded the Erie on a cruise to Africa, where he secured the territory which now forms the present Liberian republic, and in the autumn of the same year was instrumental in the suppression of pirates and slavers in the West Indies. He strongly advocated a steam navy and drew the plans for the sloop of war Princeton on which an exploding gun killed the secretaries of war and the navy in 1844. He was commander of the Pacific squadron during the Mexican War, when he took possession of California in the name of the United States. After his resignation from the navy in 1850 he devoted himself to politics, and in 1851 was elected to the United States Senate, and introduced a bill, subsequently passed, abolishing flogging in the navy. On leaving the Senate in 1853 he turned his attention to the improvement of the Delaware and Raritan Canal, an enterprise he had previously encouraged.

Stockton, Cal., city, the metropolis and chief distributing centre of the San Joaquin Valley, county-seat of San Joaquin County; 78 miles northeast of San Francisco and 397 miles northwest of Los Angeles.

Climate and Health.— The climate of Stockton is even and healthful, being practically the same as that of southern California and of the countries of southern Europe bordering on the Mediterranean. Under the influence of the prevailing westerlies the winters are mild, while in summer the local sea breezes temper all extremes of temperature. The nights are always cool. Within a radius of five miles from Stockton may be found practically all products of both temperate and sub-tropical countries. The orange and the cherry, the grape and the pear, the fig and hardy grains, the palm and the prune, are seen growing equally well side by side. Flowers are in bloom in the open air twelve months of the year. The mean average temperature (United States Weather Bureau Records, 1871 to 1904) varies from 46.4 degrees Fahrenheit in January to 72.7 degrees in August; average mean annual temperature 60.1 degrees; average annual rainfall, 15.54 inches. In 1903, there were 46 rainy days, 56 cloudy days, 34 partly cloudy days, and 275 clear days. During the same year Los Angeles had 148 clear days; San Francisco, 178; San Diego, 247.

All sewage is pumped into the San Joaquin River, three miles distant. The rain water system is so distributed as to drain all parts of the city of surface waters. The water supply is excellent. Besides the water from deep wells supplied by a private corporation, many residents secure water from wells that vary from 80 to 125 feet in depth. Average death rate per thousand inhabitants, 13.3.

Transportation and Commerce.—Stockton is favorably situated to command the trade of the San Joaquin Valley and of the mining and lumbering districts along the eastern rim of the valley. The main line of the Atchison, Topeka and Santa Fe and two lines of the Southern Pacific connect Stockton with both San Francisco and points in the San Joaquin Valley to the southward; the Stockton and Copperopolis Road and the Sierra Road extend from Stockton to the lumbering and Mother Lode mining regions of the Sierras; the Central Pacific to Sacramento, 49 miles to the northward; the Alameda and San Joaquin to the Tesla Mines, 36 miles to the west; a narrow gauge feeder of the Southern Pacific extends from Lodi (12 miles north of Stockton) to Valley Springs, 27 miles distant. Stockton is on the surveyed line of the Western Pacific (1904), a transcontinental line to connect San Francisco with Salt Lake City. The Yosemite Valley and the Calaveras and Tuolumne Groves of Big Trees are reached by rail and stage from Stockton. Within 25 miles of Stockton are 200.9 miles of railroad, 263 miles of navigable channels and 1,200 miles of improved wagon roads.

The city is at the head of all-the-year navigation on the San Joaquin River system, being connected to the river by a navigable channel 2½ miles in length. To San Francisco by water is 85 miles. Steamers discharge passengers and freight at the head of the channel in the geographical centre of the city. For a distance of one mile to the western limits of the city, the channel harbor is lined with flouring mills, lumber yards, ship yards, warehouses, coal bunkers, etc. River traffic was carried on from Stockton as a centre by about 15 stern wheel steamers, 36 barges, 77 schooners, and 7 tugs. Two lines of steamers ply daily between Stockton and San Francisco. A report printed by order of the United States Senate Committee on Commerce showed that the regular daily traffic on the San Joaquin River between Stockton and San Francisco averaged 5,000 tons daily, and that 144,000 passengers were carried between the two places by steamer during the year.

The central point in the city is 18 feet above mean tide in Suisun Bay. The waters in Stockton Channel are affected by the tides, the greatest variation between high and low tides being 40 inches. The general government maintains a depth of 9 feet in the channel at mean low tide. To protect Stockton Channel from shoaling, Congress, in 1902, appropriated $225,000, to dig a canal to divert all tributary waters to the Calaveras River. The California Legislature appropriated $60,000 to purchase the rights of way. All wharf and tonnage dues and 4 per cent of the revenues of the city are used in building permanent bulkheads and in otherwise improving the harbor. Since the beginning of the grain industry of California, Stockton has been the principal grain market of the great central valley. The 13 grain and produce warehouses in the city have an aggregate capacity of 175,000 tons; its hay warehouses, 25,000 tons; all conveniently located to handle shipments by both rail and water. Grain is transported from Stockton to ocean vessels in San Francisco Bay for 65 cents per ton. Terminal rates are given shippers by all transcontinental lines. In 1902 the district of which Stockton is the terminal point, shipped from California by rail 105,178.4 tons of fruits (green, dried and canned), vegetables (green and canned), nuts, wine and brandy. Forty-nine commodities are shipped

Digitized by Google

annually from Stockton in carload lots, the most important being agricultural implements, grain, beans, engines, flour and millstuffs, hay, live stock, onions, potatoes, wine, brandy, grapes, fruits and leather.

Manufactures.— Abundance of raw material, cheapness of power, low transportation rates, and location as a distributing centre have developed the manufacturing interests of the city. By the census of 1900 there were 293 manufacturing establishments with an annual output valued at $6,907,839. Fuel oil from the upper San Joaquin Valley is the most common source of power. With fuel oil at recent current prices, power can be generated in Stockton as low as one fifth of a cent per horse-power per hour. Electricity, coal, and natural gas are also used as sources of power. From the source of power on the Mokelumne River, 45 miles distant, a line with a capacity of 15,000 horse-power delivers electricity in Stockton for lighting and for manufacturing purposes. A second line completed in 1904 with a capacity of 4,000 horse-power extends from the south fork of the American River to Stockton, a distance of 80 miles. Fifteen wells, varying in depth from 1,800 to 2,300 feet, supply natural gas for home and factory use.

The city is the centre of the flour industry of the State. The four mills have a daily capacity of 5,500 barrels. A large part of the output is shipped to China, Japan, Alaska, and other Pacific countries. Combined harvesters, traction engines, disk harrows and other types of agricultural machinery are important manufactures. The combined harvester factory covering about nine acres, is the largest factory of its kind in America. The harvesters made here cut, thresh, and sack the grain by a continuous process. The only window glass factory west of the Mississippi River has an annual capacity of 75,000 boxes of glass. A woolen mill manufactures cassimeres, cheviots, tweeds, flannels, and blankets, and markets more than two thirds of its product in New York, Philadelphia, and Boston. A coal briquette factory (the only one in the United States) with a daily capacity of 600 tons consumes the entire output of the Tesla Coal Mines. From the time the coal is ground until the finished briquettes are dropped into the bunkers, the process is continuous. Machine works and foundries supply ore cars and other mining machinery throughout the Pacific coast. A large cannery uses a large part of the output of the numerous orchards and truck gardens near the city. The only wheat starch factory west of the Mississippi River is now (1904) being completed. Other important manufactures are leather, dredgers, barges, engines (gas, gasoline, marine, distillate and crude oil), ice, beer, wine, brandy, olive oil, distillate oils, butter, insect powder (Buhach), macaroni, pumps, windmills, stages, gloves, soap, paint, soda waters, medicines and cigars.

Tributary Region.— Stockton is situated in the centre of a rich grain, orchard, vineyard, produce, and dairying section. Within 20 miles of the city are 22 towns and villages. On the upland tributary region the most common soils are adobe and black and sandy loams. West of the city is the largest area of peat lands in the United States. In the natural state these lands were covered with a thick growth of a coarse reed called the tule, and were overflowed each year. By means of levees an area of 160,000 acres has been reclaimed. Many of these reclaimed tracts are surrounded by navigable branches of the San Joaquin River. These peat lands are especially adapted to dairying and to the growth of potatoes, beans, onions, asparagus, celery, chicory, and grain. On Rough and Ready Island one herd of Holstein-Friesian cattle has 68 cows in the advanced register. From this herd Juliana De Kol, a 2½-year-old heifer, in a recent thirty-day official test, established a new world's record, giving 1,852 pounds of milk, making 92 pounds 7½ ounces of butter.

Of the chief agricultural crops of California classified under 36 heads (census 1900), 28 are produced in marketable quantities near Stockton. All the chicory produced on the Pacific coast is grown near the city. In the production of wheat, barley, rye, asparagus and potatoes, this region leads all other sections of the State. More barley is grown within a radius of 25 miles of Stockton than in any other area of the same size in the United States. Other leading agricultural products are alfalfa, beans, onions, truck farm products, sugar beets, table and wine grapes, almonds and deciduous fruits. The yield and value per acre (census 1900) of important crops were: Beans, 35.5 bushels, $55.03; onions, 402.2 bushels, $232.28; potatoes, 124.1 bushels, $62.05; barley, 17.4 bushels, $9.57; almonds, 461 pounds, $41.34.

The winter rains are sufficient to mature grain and many other crops. Three canal systems drawing water from the Stanislaus, Mokelumne and Calaveras Rivers, respectively, irrigate 40,000 acres near the city. Many small farms are irrigated by pumping plants operated by gasoline engines, windmills, or electric power. On the peat lands water is secured through flood gates constructed in the levees. During the decade from 1890 to 1900 (census 1900), the number of irrigators in the area near Stockton increased 392.9 per cent; the acres irrigated, 719.3 per cent, the greatest proportionate increase in California.

Utilities, Public Buildings, Finance.— Stockton is an attractive city having 11 public parks, a well-equipped electric street car system, a complete rainwater and sewer system and 109 miles of streets, of which 11 miles are improved with macadam, 5 with bitumen, 2 with basalt blocks, and 15 with gravel. At the southern terminus of the street car system are mineral baths from warm artesian waters. It is one of the best shaded cities in California, the most popular trees along the streets and in the gardens being the elm, the maple, the acacia, the orange, the palm, the oleander, and the umbrella tree. From 40 wells, varying in depth from 250 to 1,100 feet, water is pumped into elevated tanks and distributed by a private corporation. These 40 wells are on a three-acre tract, and, although they supply an average of 2,500,000 gallons of water daily, they have never been pumped dry during the 20 years the system has been supplying the city. Rates are regulated by the city council.

The city has a paid fire department with 30 employees and three steamers, two chemical engines, three hose wagons and one hook and ladder truck; a police department with 18 men; a

Digitized by Google

1. Typical Pasture Scene in Central California. 2. View of Stockton Harbor.

Digitized by Google

post-office of the first class with an annual revenue of about $50,000, 47 employees and five rural delivery routes; a rural telephone system reaching all nearby farmers and villages; 2,283 telephones in the city (by last available report) or 13.04 to each 100 persons as compared with 12.13 in San Francisco and 13.12 in Los Angeles; 30 church organizations and 17 buildings used for religious purposes, one (the Central M. E. Church) costing, furnished, $91,000; 14 public school buildings enrolling about 2,800 pupils; the high school building with ten-acre site costing $155,000; three parish schools, including St. Agnes Academy; two business colleges and a number of smaller private schools; a public library costing $75,000 and having 37,000 volumes and 5,198 pamphlets, maps, and atlases; 12 hotels. Among other prominent buildings are the State Hospital for the Insane; the county court-house, a granite building costing $350,000; the United States Post Office of sandstone costing $108,000; the opera house; St. Joseph's Home; Masonic Temple, and many substantial business blocks. Four daily papers, one semi-weekly, five weekly and four monthly papers are published in the city.

The six banks of Stockton have a paid up capital of $2,158,580, with deposits amounting to over $5,500,000, and loans aggregating $6,500,000. Since their incorporation in 1887 and 1889 two Building and Loan Associations with 1,100 local stockholders and assets amounting to $583,851, have erected 880 homes in the city through loans aggregating $2,807,794. The assessed valuation of all property in the city proper is about $15,-000,000; bonded indebtedness, $144,000.

History and Government.— In 1843, Capt. C. M. Weber, the founder of Stockton, secured a grant of 11 square leagues of land (48,747 acres) from the Mexican government. This grant known as the Campo de los Franceses included the site of the present city of Stockton. At first stock raising was the only industry. With the discovery of gold in 1848, Stockton became at once the most important supply station for the Southern Mines. At the head of navigation on the San Joaquin River, goods were brought on sailing vessels from San Francisco to Stockton, the nearest point to the mines. From Stockton supplies were sent to the miners by ox teams, by pack animals or in huge wagons known as «prairie schooners.» As grain farming developed, the city naturally became the shipping point for the entire tributary region. The completion of the first overland railroad in 1869 greatly increased the importance of Stockton as a manufacturing and distributing centre. In 1850 Stockton was incorporated with a population of 2,000. It was named in honor of Robert Field Stockton of the United States Navy. It was laid out in blocks 303 feet square. Under the charter of 1889, the government is vested in a mayor and a council of five members chosen biennially.

Population.—(1890) 14,424; (1900) 17,506. A complete census of the city is taken each year by the school census marshals. Population of the city proper (1910 census), 23,253; of the city and suburbs, 29,000.

JAS. A. BARR,
City Superintendent of Schools, Stockton, Cal.

Stockton-on-Tees, tēz, England, a seaport town in Durham, on the Tees River, 11 miles northeast of Darlington. It consists of two sections, the town proper, and South Stockton of more recent date, connected by a bridge. It has municipal buildings, a custom-house, many good churches, quays, and steam tramways. There is a fine race-course in the vicinity, and Ropner Park, laid out in 1893. Ship-building is an extensive industry and there are important foundries, blast-furnaces, engine-works and potteries, breweries, corn and spinning-mills. The exports include iron-ware and pottery; the imports are chiefly corn, timber, etc. There is quite a brisk river trade.

Stoddard, stŏd'ard, **Amos,** American soldier: b. Woodbury, Conn., 26 Oct. 1762; d. Fort Meigs, Ohio, 11 May 1813. He served in the Revolutionary War and at its close practised law in Maine. He was governor of the Territory of Missouri, 1804–5, fought in the War of 1812 and was mortally wounded in the siege of Fort Meigs. He published 'Sketches of Louisiana' (1810), and several valuable historical papers.

Stoddard, Charles Augustus, American Presbyterian clergyman, and writer of travels: b. Boston 28 May 1833. He was graduated from Williams College in 1854; taught; traveled in Europe and the East; studied at the University of Edinburgh and the Free Church of Scotland Theological Seminary; and was graduated from Union Theological Seminary in New York in 1859. He was pastor in a Presbyterian church in New York 1859–83; became associate editor of 'The Observer' in 1869, part owner in 1873, and was editor-in-chief, 1885–1902. His publications include 'Across Russia from the Baltic to the Danube' (1891); 'Beyond the Rockies' (1894); 'Cruising Among the Caribbees' (1895–1903).

Stoddard, Charles Warren, American author: b. Rochester, N. Y., 7 Aug. 1843. He studied at the University of California and was for some time an actor. He was for seven years special traveling correspondent of the San Francisco *Chronicle,* visiting nearly every quarter of the globe, including five years in the South Seas; from 1885 to 1887 professor of English literature at Notre Dame College, Indiana; and from 1889 to 1903 at the Catholic University of America. Among his publications are: 'South Sea Idylls' (1873); 'Summer Cruising in the South Seas' (1874); 'Mashallah' (1880); 'The Lepers of Molokai' (1885); 'Lazy Letters from Low Latitudes' (1894); 'Over the Rocky Mountains to Alaska' (1899); 'Hither and Yon'; etc. He died 24 April 1909.

Stoddard, Elizabeth Drew Barstow, American poet and novelist: b. Mattapoisett, Mass., 6 May 1823; d. New York 1902. She was married to R. H. Stoddard (q.v.) and frequently collaborated with him in literary work. In addition to verse of not a little individuality she wrote three novels 'The Morgesons' (1862); 'Two Men' (1865; and 'Temple House' (1867), which displayed vigor and originality, but were never popular. Her 'Poems' were collected in 1867.

Stoddard, Francis Hovey, American educator and writer: b. Middlebury, Vt., 25 April 1847. He was graduated from Amherst College in 1869, and was instructor at the University

Digitized by Google

of California 1886–7. Since 1888 he has held the chair of English literature at New York University. He has published 'The Modern Novel' (1883); 'Women in the English Universities' (1886); 'Miracle Plays and Mysteries' (1887); 'Tolstoi and Matthew Arnold' (1890); 'The Evolution of the English Novel' (1900).

Stoddard, John Lawson, American lecturer and traveler: b. Brookline, Mass., 24 April 1850. He was graduated from Williams College 1871. He has traveled extensively and is the originator and promoter of the Stoddard Lectures in the larger cities of America. He has published 'Red Letter Days Abroad'; 'Glimpses of the World'; 'Stoddard Lectures on Travels Abroad and in America.'

Stoddard, John Tappan, American chemist and educator: b. Northampton, Mass., 20 Oct. 1852. He studied in the Northampton High School and later went to Amherst College, graduating from there in 1874. He then went to Germany, taking a two years' course in chemistry and physics at the University of Göttingen (1876–8), receiving his degrees of A.M. and Ph.D. in 1877. He was assistant principal of the Northampton High School, 1874–5; was professor of physics and mathematics in Smith College 1878–81, of chemistry and physics 1881–97, and of chemistry since 1897. He has written: 'Outline of Qualitative Analysis' (1883); 'Lecture Notes on General Chemistry' (2 vols. 1884–5); beside many scientific articles and review for magazines.

Stoddard, Richard Henry, American poet and journalist: b. Hingham, Mass., 2 July 1825; d. New York 12 May 1903. He went to New York when very young, and there he was employed for some time in an iron-foundry. He began, about 1848, to write in prose and verse for periodicals, and ultimately devoted himself to literature. From 1853 to 1870 he was connected with the custom house, in 1870–3 he was secretary to Gen. McClellan, in 1860–70 was literary reviewer for the *World,* and from 1880 for the *Mail and Express* (now the *Evening Mail*). The amount of his critical work in these posts was very large. He wrote much worthy verse, lyric and narrative, of a reflective cast; patterned in the earlier period after Keats. 'Abraham Lincoln,' an ode, is among his best-known efforts. Among his numerous writings are 'Footprints' (1849); 'Songs of Summer' (1856); 'The King's Bell' (1862); 'The Book of the East' (1871); 'Memoir of E. A. Poe' (1875); 'Poems' (1880, collected); 'Life of Washington Irving' (1886); 'The Lion's Cub' (1890), poems; and 'Under the Evening Lamp' (1893), essays on Hogg, David Gray, Ebenezer Elliot, Edward Fitzgerald, and others. His valuable collection of autographs and manuscripts was presented by him to the New York Authors' Club, a few months before his death. Consult his 'Recollections, Personal and Literary,' edited by Ripley Hitchcock, with introduction by E. C. Stedman (1903).

Stoddard, William Osborne, American author and journalist: b. Homer, N. Y., 24 Sept. 1835. He was graduated from the University of Rochester in 1857, tried farming and journalism until 1861, when he was three months in the United States volunteers. He was secretary to President Lincoln 1861–4, and United States marshal of Arkansas 1864–6. Since then he has followed journalism and business pursuits in New York and has taken out nine patents for inventions. His publications are numerous and comprise verse, biography, fiction, and adventure stories for boys. Among them are 'Scanderoon' (1870); 'Life of Abraham Lincoln' (1884); 'The Talking Leaves' (1885); 'The Red Mustang' (1890); 'The Lost Gold of the Montezumas' (1897); 'The Errand Boy of Andrew Jackson' (1902).

Stoddart, James Henry, American actor: b. Barnley, Yorkshire, England, 12 Oct. 1827; d. Sewaren, N. J., 9 Dec. 1907. He was educated at Glasgow, and at 17 began his career as an actor, attaining some success in Liverpool and other English cities. In 1854 he came to the United States and was one of Wallack's company; then acted with Laura Keene and with Dion Boucicault. He was later for 20 years under the management of A. M. Palmer at the Union Square and Madison Square theatres, New York. He was most successful in his representations of old men; among his roles are Mr. Moneypenny in 'The Long Strike'; Colonel Preston in 'Alabama'; and Lachlan Campbell in 'The Bonnie Brier Bush.' He wrote 'Recollections of a Player' (1902).

Stoddert, stŏd'ėrt, **Benjamin,** American Revolutionary soldier and statesman: b. Charles County, Md., 1751; d. Bladensburg, Md., 18 Dec. 1813. He was educated for mercantile pursuits, but on the outbreak of the Revolutionary War entered the Continental army and served with distinction until the battle of Brandywine, when he was severely wounded and obliged to retire from active service. At the time of his retirement he had the rank of major. He was secretary of the board of war till 1781. At the close of the war he established a mercantile business at Georgetown, D. C. In 1798 he was appointed secretary of the navy, holding the position till 1801. During his administration war with France was threatened, and he had charge of the organization of the naval force; for a time he served also as secretary of war. At the close of his term he returned to business in Georgetown.

Stoeckel, Gustave Jacob, American musician and instructor: b. Maikammer, Germany, 9 Nov. 1819; d. Norfolk, Conn., 17 May 1907. He graduated from Kaiserslautern, Germany, and for several years was a teacher and organist. He came to the United States in 1847, becoming instructor in music at Yale University in 1849 and the organist in College Chapel. After 1890 he was professor emeritus of music. He published several collections of sacred music, several operas, a College Hymn Book for male voices, etc.

Stoessel, Anatoli Mikhailovitch, Russian general: b. of Swedish parents in Saint Petersburg, 10 July 1848; was educated in Paul Military School, St. Petersburg, and entered the army in 1864, serving with distinction in the Russo-Turkish War, 1877–8; was appointed colonel in 1889, major-general in 1899, commander of the Ninth East Siberian Sharpshooters' Brigade, 1900, and for meritorious services against the Boxers in the same year, was made a lieutenant-general. At the outbreak of the Japanese war in February 1904, he was ap-

Digitized by Google

pointed commander at Port Arthur, and soon afterward commander of the entire army corps ordered to the defense of that fortress, which he surrendered to the Japanese, 2 Jan. 1905. On 20 Feb. 1908 he was condemned to death (commuted to 10 years' imprisonment) «for surrendering the fortress before all means of defense had been exhausted; failing to enforce authority; and for military misdemeanors.»

Stoever, Martin Luther, American educator and author: b. Germantown, Pa., 17 Feb. 1830; d. Gettysburg, Pa., 22 July 1870. He graduated from Pennsylvania College, Gettysburg, in 1838, and was a tutor there from 1839 to 1840, afterward becoming principal of the preparatory department, and professor of Latin, history, and political economy, a position which he very ably held until his death. He received the degrees of Ph.D. and LL.D. For several years he acted as secretary of the General Synod of the Lutheran Church, and as editor of the 'Evangelical Quarterly Review,' for which he wrote a series of 'Reminiscences of Lutheran Ministers.' He also edited 'The Literary Record' from 1847 to 1848. He published biographies of Dr. Henry M. Muhlenberg (1856), and of Dr. Philip F. Mayer (1859), and wrote 'A Brief Sketch of the Lutheran Church in the United States' (1860), and at the time of his death was preparing a full history on that subject.

Stohman, stō'man, **Friedrich Karl Adolf,** German agricultural chemist: b. Bremen 1832. He was educated at Göttingen University in Germany, was assistant professor under Graham at University College from 1853 to 1855, and afterward assistant at Celle. He organized the department for agricultural experiments at Brunswick in 1862; in 1865 he accepted a call to Halle, and in 1871 became director of the agricultural physiological institute of Leipsic University. He wrote: 'Beiträge zur Bedgründung einer rationellen Fütterung der Wiederkäuer' (1860); 'Biologische Studien' (1873); 'Handbuch der technischen Chemie' (1872); 'Handbuch der Zuckerfabrikation' (1878); 'Die Starkefabrikation' (1878).

Stoicism, the Stoic system of philosophy and practical attitude toward life. The Stoic school of philosophy was founded at Athens about 300 B.C. by Zeno, a native of Citium, in Cyprus. It received its name from the Stoa Pœcile, or mottled porch, where its meetings were held. Zeno had been a pupil of the Cynic Crates, and in its essential principle Stoicism may be regarded as the continuation and scientific development of Cynicism (q.v.). The successor of Zeno in the leadership of the school was Cleanthes, the author of the hymn to Zeus, who died 251 B.C. He was followed by Chrysippus, who, on account of his great activity as a teacher and writer, is sometimes called the second founder of the school. The leadership at Athens then passed the order to Zeno of Tarsus, Diogenes of Seleucia, and Antipater of Tarsus. Of the numerous writings of these men and their contemporaries only a few fragments have come down to us.

Panætius of Rhodes (180–110 B.C.) and his contemporary, Boethius of Sidon, introduced new elements into Stoicism, bringing it into closer relations with the systems of Plato and Aristotle. It was mainly through the influence of the former that Stoicism was introduced into Rome. Panætius was the friend of Scipio Africanus and of Lælius, and the teacher in philosophy of many Roman youths of distinguished families. Cato, the younger, is perhaps the most famous Roman Stoic of the time of the Republic. By the time of the Empire, the original form of Stoicism had been greatly modified by the prevailing eclecticism of the age, and may almost be said to have ceased to exist as a scientific system. It still survived, however, as a popular moral philosophy, and in this form gave expression to many of the noblest ethical and religious convictions of the ancient world. Its chief representatives at this time whose works are still extant were Seneca, Epictetus, and the Emperor Marcus Aurelius.

Stoicism, like all the later systems of Greek thought, was primarily practical in character. The end and object of philosophy for the stoic was to teach virtue as the art of right living. But, in order to act rightly, it is necessary to be able to reason correctly, and to understand the nature of the universe of which man is a part. Hence, logic and physics were regarded as indispensable preliminary studies for ethics, but not as possessing an independent value of their own. The extensive logical investigations undertaken by the Stoics contributed little of permanent value for the development of the science. In physics, their general view of the universe may be described as pantheistic materialism. Whatever exists is for the Stoics a material body. Not only do they maintain that all substances — including the soul and God — are corporeal, but they go on to describe as material all properties and relations of things, and even virtues and vices. Their view of the world was, however, essentially dynamic: all is process and movement. Moreover, the world-process forms a single whole, whose unitary principle is sometimes described in material terms, similar to those of Heraclitus (q.v.), as fire of warm breath, sometimes in spiritual terms as God, Providence, the Logos or Universal Reason, or Universal Law. In spite of the variety of terms, these names all have for the Stoics the same meaning, and describe at once both the essential substance of the world, and the ordering power and principle according to which it is regulated. There is no distinction to be made between God and the world, between matter and force. Further, these statements imply that every part of the world is ruled by the same unchanging laws, and is thus subjected to strict necessity. There is no chance or contingency anywhere; everything is ruled and governed by unvarying laws.

Man only differs from the other parts of the universe in that, as possessing consciousness and reason, he is able to learn the laws of nature and to follow them consciously and voluntarily. Hence we find that the fundamental doctrine of the Stoic ethics is contained in the injunction to «follow nature,» to lead a «life according to nature.» This general principle was made more specific, however, when it was pointed out (it is said by Chrysippus) that the laws of nature with which man is most directly and intimately concerned are those of human nature, and that he must therefore obey the fundamental laws which are found within himself. This implies that reason, the fundamental princi-

Digitized by Google

ple of human nature, shall govern action. Between the reason and the life of feeling and emotion there is the sharpest opposition. The highest good is not pleasure, or any object of desire, but virtue, the end which reason shows to be in harmony with our true nature. This sharp antithesis between virtue and pleasure was doubtless made more emphatic by the rivalry between the Stoic and the Epicurean schools. To regard pleasure as the good is, they maintain, to lose sight of the true nature of virtue, to base it upon the feelings and emotions, which are subject to external circumstances, and thus to deprive a man of his moral freedom and independence. The ideal of the wise man plays a very important part in the Stoic ethics. The wise man is completely free and independent, completely independent of external circumstances, and entirely emancipated from the bondage of the desires and emotions. For him virtue is the only good and vice the only evil: all external circumstances are indifferent; health, power, riches, even life itself are not real goods, nor is pain, poverty, contempt, or death evils. He has completely mastered his possessions through the insight of reason and the resulting strength of will, and has attained to a state of apathy, or freedom from the sway of the emotions. This ideal has been realized at best by very few men; the Stoics refer only to Socrates and Antisthenes, the founder of the Cynic school, as examples of its complete fulfillment. The wise man recognizes the necessity of all events, and welcomes whatever takes place as a part of the divine order of the universe.

The fundamental Stoic virtues are thus strength of will, and resignation based on rational insight. These enable a man to bear cheerfully whatever lot fortune may apportion to him. Even when external circumstances make endurance no longer possible, but would compel a man to unworthy action, he may still triumph by voluntarily withdrawing from life by suicide. The Stoic gives up life, as he gives up external goods, as a means of preserving his own freedom and independence; and many of the most famous members of the school committed suicide in this spirit. In spite of the emphasis on the necessity of independence, the Stoics recognize that a life of reason implies social relations with one's fellow men, and they give an important place in their system to the social duties and virtues, especially to the importance of justice, mercy, and friendship. As reason is the essential basis of society, being the common element that unites a man with his fellows, they attach slight importance to citizenship in a particular country, and emphasize the cosmopolitan idea of social unity with all rational beings of every society and of every country. In this and in other doctrines, Stoicism, especially in its later form, goes beyond the conceptions usually prevailing in Greek ethics, and approaches the Christian idea of the universal brotherhood of man.

Bibliography. — Seneca, 'Dialogues' (tran. by A. Stewart in Bohn Library); Epictetus, 'Discourses and Encheiridion' (tran. by G. Long in Bohn Library); Marcus Aurelius, 'Thoughts' (tran. by G. Long in Bohn Library); Capes, 'Stoicism' (1880); Zeller, 'Stoics, Epicureans and Sceptics'; Brown, 'Stoics and Saints' (1893); Davis, 'Greek and Roman Stoicism' (1903).

JAMES E. CREIGHTON,
Professor of Philosophy, Cornell University.

Stoke-Poges, stōk pō'jĭs, England, a village of Buckinghamshire. It is the burial place of Thomas Gray, and its churchyard is the scene of the famous 'Elegy.'

Stoke-upon-Trent, England, a seaport and market-town, in Staffordshire, 14 miles northwest of Stafford, capital of the "Potteries" district. It dates mainly from the 18th century and has been greatly improved recently. The municipal buildings, free library, Minton Memorial, Hartshill infirmary, monuments to prominent citizens, and public baths are noteworthy features. The industries and manufactures are varied, including earthenware, porcelain, tiles, tesselated floors or pavements, coal-mining, the manufacture of machinery, engines, etc. Pop. (1901) 30,458.

Sto'ker, Bram (Abraham), English author: b. Dublin. He was educated in that city, and has published 'Under the Sunset' (1882); 'The Watter's Mou'' (1894); 'The Shoulder of Shasta' (1895); 'Miss Betty' (1898); and 'The Mystery of the Sea' (1902).

Stoker, Sir (William) Thornley, Irish surgeon: b. 6 March 1845. He obtained his early education in the Wymondham Grammar School, later studying in the College of Surgeons, Ireland, and Queen's College, Galway. He rapidly attained eminence in his practice and was created a knight in 1895 in recognition of his services to surgery. He was appointed surgeon to the City of Dublin Hospital in 1873; has been surgeon to Richmond Hospital since 1873, and Swift's Hospital since 1876, later becoming governor. He has been professor of anatomy in the Royal College of Surgeons, Ireland, 1876–89 and its president, 1894–6; governor of the Royal Hibernian Military School, the House of Industry Hospitals, and of the National Gallery, Ireland; he was appointed inspector for Ireland under the Vivisection Act, and has been a Fellow of Royal University since 1890. He has contributed many scientific papers on his profession to magazines and periodicals.

Stokes, Adrian, English painter: b. Southport in 1854. He received his education at the Liverpool Institute and the Royal Academy Schools, London. He has exhibited works at the Royal Academy each year since 1876, and has been awarded medals at the Paris Exhibition, 1889, and the World's Fair at Chicago, 1893.

Stokes, stōks, **Frank Wilbert,** American artist: b. Nashville, Tenn., 1861. After receiving an academic education, he studied art at the Philadelphia Academy of Fine Arts and then in Paris. In 1892 he accompanied the Peary relief expedition, and in 1893–4 he was with the North Greenland expedition. He became identified with the Anthropological Society, the Geographical Society, the Polar Research Club, and the Academy of Natural Sciences in Philadelphia. His publications include essays on 'Color in the Far North' (1894); 'An Arctic Studio' (1896); 'Essentials of Polar Expeditions'; etc.

Stokes, stōks, **Sir George Gabriel,** British mathematician and physicist: b. Skreen, County Sligo, Ireland, 13 Aug. 1819; d. 1903. He was

Digitized by Google

graduated at Cambridge in 1841, in the same year was elected a fellow of Pembroke College, and was elected Lucasian professor of mathematics at Cambridge in 1849. In 1885 he became president of the Royal Society, and from 1887 to 1892 was member of Parliament for Cambridge University. He was made a baronet in 1889, and in 1902 became master of Pembroke College. He was distinguished as an expounder of the principles of hydrodynamics, of spectrum analysis, and of the phenomena of fluorescence and phosphorescence, and his publications include the 'Burnet Lectures on Light' (1892); 'Mathematical and Physical Papers' (1880–1902); 'Gifford Lectures on Natural Theology' (1891–3); and many papers printed in the transactions of learned societies.

Stokes, Whitley, Irish Celtic scholar: b. Dublin 28 Feb. 1830. He was educated at Trinity College, Dublin, and called to the bar at the Inner Temple in 1855. He went to India in 1862, and became successively secretary to the governor-general's legislative council and to the legislative department of the government of India. In 1877–82 he was law member of the governor-general's council, and during his official career in India drafted the greater part of the present codes of civil and criminal procedure as well as numerous acts relating to property, trusts, etc. In 1879 he was president of the Indian Law Commission. In 1868 he proposed a scheme for collecting and cataloguing the Sanskrit manuscripts preserved in India. His published works include those treating of legal, and those dealing with Celtic subjects. The former comprise 'Treatise on the Liens of Legal Practitioners' (1860); 'On Powers of Attorney' (1861); 'Hindu Law Books' (1865); 'The Older Statutes in Force in India, with Notes' (1874); and 'The Anglo-Indian Codes' (1887–8; supplements, 1889–91); etc. Among his Celtic works may be named 'Irish Glosses' (1860); 'Three Irish Glossaries' (1862); 'The Play of the Sacrament' (1862); 'The Passion, a Middle Cornish Poem' (1862); 'The Creation of the World, a Cornish Mystery' (1863); 'Three Middle Irish Homilies' (1871); 'The Tripartite Life of St. Patrick' (1887), in the Rolls Series; 'Lives of Saints from the Book of Lismore' (1889); 'Urkeltischer Sprachschatz' (1894), with Bezzenberger; 'The Annals of Tigernach' (1897); 'The Eulogy of St. Columba' (1899). He is joint-editor of 'Irische Texte' and of the 'Archiv für Celtische Lexikographie.'

Sto'la, the Latin name of a loose garment worn by Roman matrons over the tunic. To the bottom of it a border or flounce was sewed, the whole reaching down so low as to conceal the ankles and part of the feet. It was the characteristic dress of the Roman matrons, as the toga was of the men; divorced women or courtesans were not allowed to wear it. It was usually gathered and confined at the waist by a girdle, and frequently ornamented at the throat by a colored border. It had either short or long sleeves, and was fastened over the shoulder by a fibula.

Stolberg, stŏl'bĕrg, **Christian,** German author: b. Hamburg 1748; d. 1821. He traveled through Switzerland and North Italy in company with Goethe and Lavater; settled in Schleswig, and wrote poems, dramas, etc., besides a translation of Sophocles and other works from the Greek. He was influenced by Klopstock.

Stolberg, Friedrich Leopold, German poet: b. Hamburg 1750; d. 1819. He wrote plays, poems, travels, etc.; translated the 'Iliad,' four tragedies of Æschylus, some of the works of Plato, and Ossian's works. In 1800 he joined the Roman Catholic Church, after which he wrote an elaborate 'History of the Religion of Jesus Christ.'

Stole, a long narrow band or scarf with fringed ends, worn by ecclesiastics of the Roman Catholic and Protestant Episcopal churches, by deacons over the left shoulder, being fastened under the right arm; by bishops round the neck with both ends pendent in front to the knees; and by priests similarly, but with the ends crossed over the breast at mass.

Stolp, stŏlp, or **Stolpe,** stŏl'pĕ, Germany, in Prussia, in the province of Pomerania, on the river of its own name, 64 miles west of Dantzic. The interesting features are a castle of the 16th century, two good churches, and the ancient town-gates, besides several schools. The industries are chiefly fishing, iron-founding, linen-weaving, and amber-turning. There is some trade in cattle, fish, geese, grain, and liquor. The port is Stolpmünde at the mouth of the river — this is also a favorite summer resort. It formerly belonged to the Hanseatic League.

Stomach. The ancients conceived digestion (q.v.) as a process of cooking, executed by the animal heat of the body. Not until the 17th century was the idea advanced that digestion in the stomach was a chemical process largely due to ferments. In 1752 Réaumur, and in 1783 Spallanzani, established that the main factor in digestion was a secretion of the stomach, the gastric juice, which dissolved and transformed the ingested food-stuffs chemically. Previous to that time — even in the 17th century — digestion was thought to be due to a mechanical trituration of the food. Réaumur knew that the secretion of the stomach was acid, but it was not until 1834 that Prout discovered that the acidity was due to hydrochloric acid (HCl). In 1836 Schwann recognized the active ferment of the gastric juice, the pepsin.

A research work of the most far-reaching importance concerning the nature of stomach digestion was executed by the American military surgeon, William Beaumont on the stomach of the Canadian hunter, Alexis St. Martin. After a gunshot wound had opened the organ, it healed not perfectly but, leaving a fistula permitting introspection and direct, objective study of digestion. The investigations of Beaumont constitute what may justly be designated as the most epoch-making research on the physiology of the human stomach. ('Experiments and Observations on the Gastric Juice and the Physiology of Digestion,' 1833.)

The digestive processes in the intestines were first systematically studied by Claud Bernard, who discovered in 1848 that the pancreatic juice digested fats. Corvoisart in 1857 discovered the albumen-digesting power of the pancreatic juice. In 1865 the secretion of the intestinal glands was gained in a pure state by Thiry. Valuable contributions to the physiology of di-

Digitized by Google

gestion in the stomach and intestines have been made by J. P. Pawlow, of the Institute for Experimental Medicine, Saint Petersburg. These scholarly researches belong to the most recent acquisitions to our knowledge of the digestive tract. Still much remains to be worked out. Even at the present time the function of the bile is not understood, nor are the functions of the liver and pancreas satisfactorily investigated. In a brief and practical account like this, the reader seeks only well-ascertained facts, and not hypotheses. What he wants to know is (1) how the stomach works under healthy conditions, what are its normal performances, and (2) how its abnormal conditions are brought about, how its diseases are manifested, and what are the best means of avoiding or curing them.

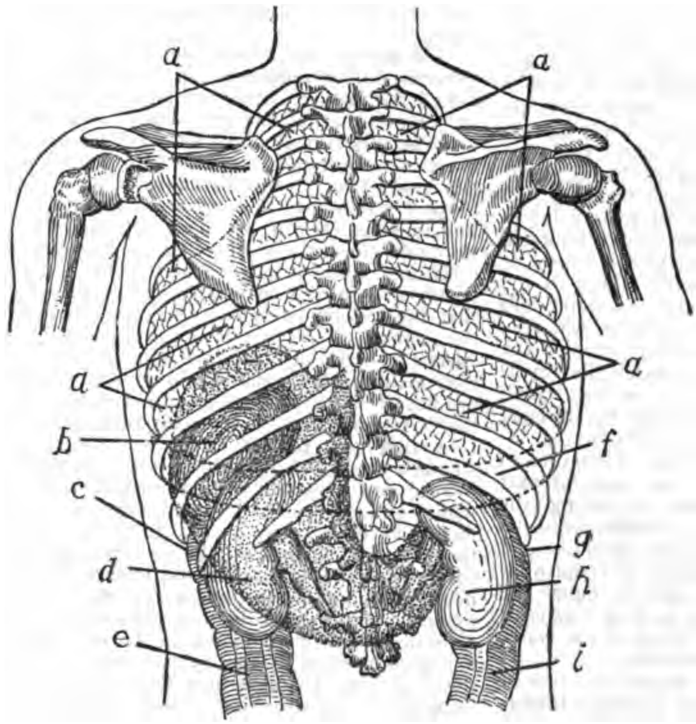
Normal Gastric Digestion.—For an understanding of the normal functions of the stomach, a brief reference to recent discoveries is indispensable. The stomach is not the main digestive organ, only one seventh of the entire digestive process occurs in it. The remaining six sevenths of digestion are carried on in the intestines. But it would be a grave error to assume for this reason that the stomach is not necessary for the digestive process. For so dependent is intestinal digestion upon gastric digestion that it is impossible to have a normal digestion in the intestines without a previous digestion in the stomach. It is also a mistake to assume that the intestinal digestion is normal in individuals who for surgical reasons have had to undergo the operation of the removal of the stomach as a whole or in part. None of such operated cases have lived over a year or six months, although they were kept under constant supervision and the most careful dietetic control.

The chemical changes which the various food-articles undergo in the stomach are of far-reaching importance for the changes which are to occur in these foods after they reach the intestines. Many of the old authors, beginning with the American physiologist, Beaumont, believe that the mechanical irritation of the foods causes the gastric secretion, but the experiments in Pawlow's laboratory have proved the fallacy of this view. In the first place, if the secretion were due to simple mechanical irritation, there is no reason why irritation with the point of a glass rod, with a feather, or with sand placed in the stomach, should not also cause the secretion. A secretion may be caused by mechanic irritation, but it is composed mainly of a liquid resembling plasma, containing mucus, and having no digestive power. The mistake of the older experimenters, according to Pawlow, grew out of the fact that they ignored the so-called psychic secretion, a secretion which can be set up by the mere smell of food, or even by a very intense feeling of hunger. If the œsophagus of a dog be cut, and its end sewed to the edges of an abdominal wound, and at the same time a gastric fistula be established, pieces of meat which are fed to the dog after healing of these fistulæ will not reach the stomach, but will fall out of the upper end of the fistula leading into the œsophagus. Nevertheless in five to six minutes after the swallowing of the food gastric juice begins to be secreted, running from the gastric canula first in drops and afterward in a continuous stream. If the dog be offered meat without receiving it, the gastric secretion will also appear, though not so plentifully as when the dog was actually allowed to eat the meat. A further interesting fact observed in dogs so experimented on was that no secretion followed the swallowing of indigestible substances like small stones. These experiments furthermore elicited the astounding fact that for every kind of food a definite gastric secretion is formed of specific composition. Therefore it may be said that the stomach provides a special gastric juice to meet each dietetic requirement. It must therefore be concluded that the mucous membrane of the stomach is capable of distinguishing between the varieties and classes of foods that come in contact with it, much as the skin recognizes mechanical, chemical, thermic, and electrical stimulation. It might be asked, «What is the object of this psychic secretion?» for Pawlow has clearly established the existence of two kinds of gastric secretion, the chemic and the psychic. This question applied to the human physiology would be the same as inquiring, «What is the object of the appetite?» The answer is, that under the influence of the psychic secretion a gastric juice is furnished which is much more effective than that which is secreted under purely chemical stimulation of the food, that is, when food is taken without any special appetite. Furthermore, under the influence of psychic secretion foods which would otherwise not stimulate the gastric mucosa to secretion become converted by the already present psychic secretion into something else which constitutes a further stimulant to the secretion of gastric juice. For instance, if a solution of albumen be administered to a dog upon which a Pawlow operation has been performed, that is, splitting off part of the stomach, with all the vessels and nerves intact, and making this second smaller stomach communicate with the abdominal wall, but not with the general cavity of the large stomach from which it is dissected (see 'International Clinics,' Series XII., Vol. II., p. 276) there will be no secretion from the small stomach, for albumen by itself does not excite chemical secretion. But if the psychic secretion is previously set up by some other means, before the albumen is placed in the large stomach — for instance, by waving a piece of meat before the dog's eyes — then, following the introduction of albumen, a secretion will be found in the small (artificial) stomach which is qualitatively and quantitatively greater than the psychic secretion alone, or when albumen is given alone, it is evident that, while albumen in itself does not excite secretion, the products of albumen do cause this secretion. The same is true of pieces of bread which, when placed in the large stomach through the fistula, will not promote a secretion; but if the dog is allowed to swallow the bread, secretion begins and continues for several hours. Psychic secretion therefore is a preparatory secretion, transforming substances, which otherwise would not stimulate the stomach into such conditions as can accomplish this stimulation. The fact that bread will cause a secretion when chewed and swallowed, and not when placed directly in the stomach through the fistula, may be interpreted (as by Pawlow and Peter Borisoff) as proving the secretion of a gastric juice under psychic influence; but — as will be shown presently — it may be due to a special body in the saliva that stimulates gastric secretion.

Digitized by Google

Further revelations from Pawlow's laboratory disclose very important relations between the various classes of food, permitting the conclusion that they may mutually advance or interfere with the digestion of their various constituents in the gastric chyme. For instance, starch paste does not by itself promote gastric secretion, but when mixed with meat it was found to accelerate the action of the gastric juice, increasing its digestive power. Furthermore, it was demonstrated that the stomach is capable of distinguishing between lactic, butyric, and hydrochloric acids, and responded to each of these acids with a varying quantitative secretion. As lactic and butyric acids are products of gastric fermentation, their stimulating influence on gastric secretion is of therapeutic importance. It is evident, therefore, not only that the stomach is extremely delicate in detecting the composition of foods and regulating the composition of its secretion correspondingly, but that it can distinguish between various organic acids. These experiments furthermore gave the clue to the treatment of gastric secretory disorders not by drugs merely, but by dietetic measures.

The writer has discovered in normal saliva a body which, if added to digesting mixtures of gastric juice, accelerates the digestive power of the gastric secretion. In other words, this new salivary constituent will effect a more rapid conversion of proteid into the albumoses and peptones, a quicker solution of boiled-egg albumen, and of fibrin, than would occur without it. The name of «salivary secretin» has been proposed for this body, which appears also to be a normal stimulant for the gastric glands.



DORSAL VIEW.
(Dotted area shows location of Stomach.)

a. Lungs. *b*. Spleen. *c*. Splenic flexure. *d*. Left kidney. *e*. Descending colon. *f*. Complementary space. *g*. Hepatic flexure. *h*. Right kidney. *i*. Ascending colon.

The human stomach accomplishes its work by the means of three essential functions, secretion, absorption, and peristalsis (this term refers to the movements of the stomach). The secretion of the gastric glands owes its digestive power to hydrochloric acid and four ferments. The quantity of hydrochloric acid amounts to two parts in the 1,000 of gastric juice. The ferments are pepsin, which acts mainly on the proteid constituents of food like meat and egg, rennin or chymosin, which acts principally upon milk, precipitating the casein; lipase, which is a fat-digesting ferment; and the new gastric ferment, «chymaze,» which is not a digestant of food, but an accelerator of the digesting action of the ferments of the pancreatic juice. (International Clinics, Vol. II., 12th Series, p. 276, article by Peter Borisof).

Dependence of Intestinal upon Gastric Digestion.— It is a prevalent opinion among the laity that the stomach has a marked absorptive power. This is a natural consequence of an older error, according to which the stomach is the chief digestive organ, it having been formerly believed that by far the greater part of the digestive act takes place in the stomach. As already intimated, the actual digestion which takes place in the stomach is insignificant compared with that which takes place in the intestine. Later it will be shown here that the secretion of pancreatic juice depends upon the liberation from the membrane of the duodenum, or first part of the bowel, of an agent called *duodenal secretin* (discovered by Bayliss and Starling), and that the liberation and secretion of this agent depends upon the presence of hydrochloric acid in the gastric chyme. So that if this acid is not present in the chyme as it enters the upper bowel, there can be no normal performance of intestinal digestion. Just as normal gastric digestion depends upon a normal condition of the mouth and normal salivary secretion, so normal intestinal digestion depends upon a normal stomach.

Absorption from the Stomach.— The amount of absorption that takes place from the stomach is surprisingly small. Water is practically not absorbed at all, for it appears that fully 95 per cent of all water taken into the stomach is passed out into the duodenum and absorbed from the intestine. Alcohol and substances in

Digitized by Google

solution of alcohol are readily absorbed. Grape, milk, cane-sugar, and maltose are absorbed in moderate amounts when they are in aqueous solution. When they are in alcoholic solution larger amounts are absorbed. Dextrin and peptones are also taken up from the stomach, but in smaller amounts than sugar. The amount of these substances absorbed increases with the concentration of the solution. But simultaneously with this absorption occurs a more or less active secretion of water into the stomach, which secretion increases or diminishes directly in proportion to the amounts of the substances absorbed. So that under certain conditions it is possible to draw more water out of the stomach by means of a stomach-tube than has been drunk half an hour previously, which certainly refutes the assumption that water could be absorbed from the stomach, and favors the view that water is not only not absorbed, but that it is actually secreted into the stomach under certain conditions. This conclusion is of great value in the treatment of certain dyspepsias characterized by a weakened condition of the gastric musculature; for in these the contractile power of the stomach is not sufficient to expel the water into the bowel at the proper time. And as water is, bulk for bulk, the heaviest substance which the human being takes into the stomach, its retention in the stomach beyond a certain length of time drags down and exhausts the already attenuated gastric muscle and dilutes the already weakened gastric secretion. Therefore in some forms of gastric atony an essential part of the treatment consists in restricting the amount of water to the lowest possible requisite, and to give it by means of colon-injections, if necessary, for a time at least; or if some of it must be taken by way of mouth, to induce the patient to lie on his right side and by means of massage to facilitate the expulsion of the water from the stomach into the intestine.

The Gastric Peristalsis or Motor Function of the Stomach.— This is perhaps the most important function of the stomach, for not only does the motor function mix and churn up the gastric contents, but it expels them at the proper time into the bowels. An animal might live without a gastric secretion, or with a stomach which could not absorb anything, but it could not live with a stomach that had no peristalsis. The muscular layer of the stomach is much thicker and stronger at the pyloric end, which is near the outlet toward the intestine, than at the cardiac end, which is the dilated rounded pouch extending in the opposite direction. The cardiac end of the stomach is therefore very quiet during the digestive act, and the principal gastric movements of churning and expulsion occur in the pyloric end where the muscles are strongest. According to Oppel, the cardiac or quiet end of the stomach in certain animals, like the horse, pig, and rat, is functionally distinct from the pyloric end. It is lined by a different kind of epithelium called pavement epithelium, and its glands have no acid secretion. Accordingly this quiet region is, even under normal conditions, the seat of active starch digestion. It has been thought that, inasmuch as the starch-converting agency of the saliva could not act in the presence of an acid like that of the gastric secretion, therefore all starch digestion was arrested in the stomach, and was not resumed until the food reached the intestine. That this is not the case is shown by W. B. Cannon, who proved that in man as in other animals the cardiac end of the stomach serves chiefly for starch digestion by the action of the salivary ptyalin during the early part of digestion in the stomach. ('American Journal of Physiology,' Vol. VI., p. 396.) This again emphasizes the importance of thorough mastication, for only thereby can the food be thoroughly penetrated by the saliva, and further starch conversion take place in the cardiac end of the stomach during gastric digestion.

The movements which food undergoes in the stomach during digestion can be studied by the aid of the X-rays. An inert and insoluble substance which is capable of cutting off the X-rays must be mixed with the food in order to make the gastric movements visible before the Roentgen apparatus. Bismuth subnitrate answers this purpose admirably. Even the movements of the human stomach can be studied by adding this insoluble substance to the food, and placing the individual who has eaten it before the X-ray instrument. In this way it has been discovered that the pyloric or highly muscular portion of the stomach is the part where the most effective gastric movements are brought about. The movements in the other portions of the stomach are not of sufficient force to be noticeable before the X-ray apparatus. It seems probable therefore that the fundus or pouch end of the stomach serves simply to push the food into the pyloric end, where it is shot to and fro for a while, and eventually expelled into the duodenum. Three or four inches from the exit of the stomach, known as the pylorus, the musculature of the stomach is particularly strongly developed (sphincter muscle of the centrum pylori); and here it is that the stomach may constrict to such an extent as to partition off a special portion of the pyloric end and expel the food into the duodenum without permitting of any regurgitation into the fundic end. All this is in contradiction of the view originally held by Beaumont, and still adopted in some of the most recent text-books of physiology, that there is a regular circuit of the food around the walls of the gastric cavity.

Structure of the Stomach.— It is impossible to enter here into a consideration of the microscopic structure of the stomach, although this is indispensable for the proper understanding of its abnormal functioning. Much is yet to be learned concerning the cells of the peptic glands and their function. It is certain, however, that the different products of the gastric secretion, the hydrochloric acid and the ferments, do not originate in the same cells, but that there are acid-producing cells and ferment-producing cells in the glands within the stomach. It is even probable that the different ferments of the stomach are produced by different cells. The organ is composed of five different coats. Passing from without inward, these are: (1) the peritoneal; (2) the muscular coat, which is in turn composed of the longitudinal and circular layers; (3) a connective tissue layer; (4) a very small thin layer of muscular tissue, called the muscularis mucosæ, separating the connective tissue from the glandular layer; (5) the glandular layer itself, innermost of all. In addition

Digitized by Google

to these structures the stomach is permeated by arteries and veins, a liberal network of lymphatics, and is richly supplied with nerves.

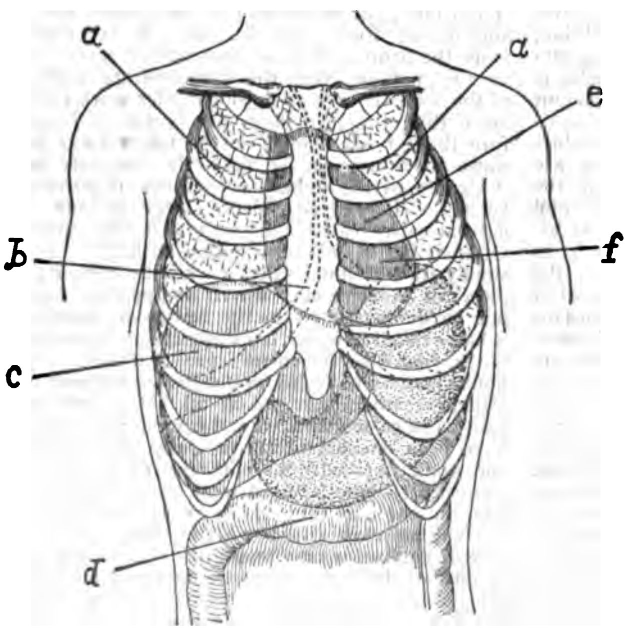
The Abnormal Digestion of the Stomach; Gastric Diseases.— One of the first and most important things to decide when an individual complains of dyspepsia, or of any distress, pain, distention, or symptom referable to the stomach, is whether the signs and symptoms are really traceable to the stomach or not. For one may have all the symptoms of gastric disease, and yet the stomach itself may not be abnormal either in structure or function. For instance, the stomach may give rise to abnormal sensations as a consequence of disease of other organs. The organs which most frequently derange the stomach in this manner are the heart, liver, and kidneys. Even physicians of experience who have become afflicted with abnormal gastric digestion have been at times deceived concerning the true source of their malady. Fully two thirds of all gastric sufferers who come to special clinics devoted to diseases of the stomach are suffering not from any primary disease of the stomach whatever, but either from a nervous affection of the stomach or from one of the gastric derangements that are secondary to disease of other organs. Perhaps the most frequent of these disorders are those that are due to the nervous gastric affections, or as they are called, the *gastric neuroses.* To determine precisely the exact nature of an affection of the stomach, the chemical analysis and microscopic examination of known test-meals is indispensable. According to the gravity of the morbid condition, a heavy or a light test-meal is given, and a certain time after it is eaten the stomach-tube is passed into the stomach, and a certain amount of the gastric contents withdrawn for analysis. As long as this is not done, all deductions from the symptoms and signs alone are conjectural. I do not mean to say that the inferences drawn from test-meal analysis and microscopical examination of test-meals are always conclusive. It is frequently necessary to examine also the blood and the urine of the patient, and even to examine the stools after certain test-meals. Then all the other organs of the body should be carefully examined, bearing in mind that it is not always correct to presume that a patient has a disease of his stomach because he has gastric symptoms. The reverse is equally true, that a patient may have no symptoms whatever referring to the stomach, and yet have very grave disease of this organ. The gravest affection which may befall the organ — cancer of the stomach — has been known to run its entire course and cause death in a latent manner; that is, without giving a single symptom referable to the stomach. This is an instance where a patient may have a gastric disease and no gastric symptom. A person who suffered from almost complete blindness, yet manifested no disease in his eyes, was found after some study to have been thus affected by poison circulating in his blood, which was absorbed from his gastro-intestinal canal, and was due to an abnormal digestion. Under treatment directed toward his stomach and intestine his vision gradually returned.

It is important to avoid aggravating an existing trouble by illogical and promiscuous medication, faulty diet, and the use of alcoholic stimulants. Between 80 and 90 per cent of the so-called stomach tonics, liver regulators, and stomach bitters are composed of alcohol. But even the prescriptions of physicians are not always adapted to the existing conditions. One of the most frequent abuses among practitioners of medicine is the indiscriminate dosing with mixtures containing pepsin. In a similar manner the ferments which convert the starches, the carbohydrates, into sugar, have been much abused. These substances are called *diastases.* Now diastase is a ferment with which the digestive tract is abundantly supplied. It exists in the saliva in the shape of a ferment called *ptyalin,* and in many hundreds of tests with human saliva it has not been discovered in a single case that this substance was not secreted in sufficient quantity. It is conceivable, however, that in a mouth which has been made offensive by carious teeth, by a badly coated tongue, enlarged tonsils, and catarrh of the mouth, throat, and nose, this ptyalin can be destroyed and rendered ineffective. The proper thing to do then is not to give ptyalin or diastase in form of a medicine, but to cure the abnormal condition of the mouth. A frequent form of gastric disturbance is called by general practitioners "amylaceous dyspepsia," which is an objectionable name given to the symptoms of hyperacidity and hypersecretion. This disease is frequently treated by cutting off the carbohydrates or starchy foods, which is irrational, because they cannot be dispensed with, not on account of the starch only, but on account of the proteid which amylaceous foods contain. It will be found from the army rations of men under service of various nations, that the carbohydrate portion of the foods is increased with harder work much more than the proteid or fat portion. Therefore these foods should not be taken away because they may not be perfectly digested; but the cause of the indigestion should, if possible, be removed. If possible, a large amount of natural saliva should be swallowed after meals. Often it has been observed that with the simple supply of additional saliva caused by chewing a piece of rubber, etc., starch indigestion could not be demonstrated in the test-meal, although it had existed before. To Fothergill is attributed the saying that "ferments are crutches." No doubt many an invalid would prefer walking on crutches rather than not at all. But there are many crutch-walkers who, by modern surgery, have been enabled to throw away the crutches and walk unaided. So with the digestive ferments; they may be used with success temporarily, but the best thing to do is to discover how the patient may digest without them. And in case of amylaceous dyspepsia this is accomplished by cure of the excess of hydrochloric acid formation, or restoring the lost motor function of the stomach. For when the starchy foods are retained in the stomach overtime, they are very apt to cause an excessive secretion, or to produce an excessive amount of organic acid by fermenting in the stomach under the influence of bacteria.

Instruction in Cooking Needed in American Schools.— One of the chief features in the treatment and also in the prevention of diseases of the stomach is then avoidance of improper medication and, what is even more important, of unsuitable diet. Much improvement is needed

Digitized by Google

in American cooking, and public kitchens and cooking-schools might be of great benefit. Serious injury is being caused by insufficient or improper food. Instruction in cooking and diet should be given in all public schools where young girls attend. For nine out of ten girls that attend these schools it will be a greater blessing, and they personally will prove a greater blessing to the community, if they know how to prepare a roast, boil potatoes and make an omelet, than if, ignorant in these things, they can give the most scholarly translation of Vergil. In Germany it is not considered below the dignity of daughters of the highest families, even those directly connected with royalty, to attend cooking schools. Nor is such an education incompatible with the best scientific and classical training. So the prevention of diseases of the stomach demands a wider and more thorough knowledge of the art of cooking. In addition to this, it necessitates a simpler life, closer adherence to the laws of nature, more freedom from business strain and nervous tension, and above all things the avoidance of excess in the use of alcoholic beverages and tobacco. Patients should be impressed with the fact that neither drugs nor any methods of treatment can improve them if they persist in their bad habits and faulty diet. Particularly must American business men, who, with admirable energy, but with little regard for their own health, persist in work too severe for their mental and physical constitutions, be taught



ANTERIOR VIEW.
(Dotted area shows location of Stomach.)
a. Lungs; *b.* Complemental pleural space; *c.* Liver; *d.* Transverse colon; *e.* Heart; *f.* Complemental pleural space.

that the prime factor in their successful treatment is rest. To such cases mental and physical rest is more essential to recovery than medicine or treatment directed to the stomach. Another factor which frequently leads up to stomach diseases is inactivity of the intestines, or constipation. This should in all cases of dyspepsia receive proper attention. When a person begins to feel distress after eating, or eructates, vomits, or has feelings of oppression, fulness or pain in the abdomen and headaches, one of the first treatments that is usually given by sympathizing friends is a drink of some alcoholic beverage, usually whiskey; then comes the abuse of pepsin; very frequently the abuse of some combination containing soda and mint, or some widely advertised panacea for the diseases of digestion. All this is generally being done in the entire absence of a correct recognition of the real disease. The safest thing for the patient to do in the absence of a logical diagnosis is to rest the stomach absolutely for 24 to 48 hours, and not take any food or medicine whatsoever; and thereafter, beginning with the very simplest kind of food — a small plate of farina, of strained oatmeal, a piece of toast, and a cup of hot milk and limewater — proceed gradually to a cup of bouillon, and a small slice of lean boiled beef. Alcohol, sugars, rich and fatty substances should be avoided for some time.

Organic Diseases of the Stomach.— These are the various forms of gastritis (catarrh of stomach, ulcer, carcinoma, etc.) and the displacements and enlargements, dilatation. Displacements — gastroptosis — may be congenital or acquired. When the stomach is displaced from its normal position, the condition is in the great majority of cases accompanied with an infirmity of the general nervous system known as neurasthenia (q.v.). Stiller has pointed out that this condition in over 80 per cent of these cases is attended by the loose or floating tenth rib. Normally the tenth rib is attached to the costal cartilages, and these to the breast-bone. But whenever the stomach is displaced out of its normal position and a very diffused splashing sound is audible over the abdomen on shaking the stomach, there is, as a rule, a very movable or floating tenth rib.

Dilatations of the stomach may be primary, due to disease of the structure of the gastric walls. In these cases there is, as a rule, no mechanical interference at the outlet of the stomach, or such interferences are secondary to some obstruction at the outlet. The causes of this obstruction may be scars from old gastric ulcers; tumors, especially cancers; indurative chronic gastritis; or any peritonitic inflammation which may constrict the stomach from the outside. Frequently gall-stones which result in pericystic inflammation may constrict the part of the bowel immediately below the stomach in such a manner that it is indistinguishable from an obstruction of the pylorus. Five such cases are recently reported in 'Progressive Medicine,' by Prof J. C. Hemmeter, December 1903, p. 45. So the cause of a dilated stomach is not always to be sought within the stomach itself.

A knowledge of displacements and dilatations of the stomach necessarily precludes a knowledge of its normal position. This is admirably

Digitized by Google

depicted in the accompanying illustrations where it is seen that the larger end of the stomach, or the blind pouch, may extend higher than the fifth rib, on the left side, thus reaching up behind the apex of the heart. This readily explains the distress felt about the heart, and also the irritable heart-action in some forms of gastric disturbance. The anterior view of this illustration also shows the correct or normal relations of the tenth rib just referred to in connection with gastroptosis. When the tenth rib is detached or floating its tip sticks out like that of the eleventh rib in this illustration. The same illustrations also demonstrate the anatomical fact that only a very small portion of the stomach is palpable through the soft part of the abdominal wall, when it is in normal position, because the larger part of it is concealed under the ribs and under the liver. So that the simple fact that we can see or feel a large part of the entire stomach projecting through the abdominal wall, when it is distended, is a sufficient evidence that the stomach is out of place. The stomach can be made visible through the abdominal wall by distending it artificially with carbon dioxide by means of an effervescent mixture containing tartaric acid and bicarbonate of soda.

The remaining organic diseases of the stomach necessitate all the intricacies of chemical and microscopical diagnosis for their detection. They include the various forms of acute and chronic gastric catarrh or, as they should preferably be called, the forms of acute and chronic gastritis, the various types of gastric or peptic ulcers, the various tumors of the stomach, especially cancer, which is becoming more and more frequent. Then there are numerous diseases of a general nature, such as tuberculosis, typhoid fever, glanders, lymphadenoma and syphilis, to be considered in the study and treatment of disorders of the stomach.

Whenever there is an organic disease of the stomach present it should be sought after with all the resources of modern clinical diagnosis. There should be no dallying with so-called stomach panaceas. Quite a number of the so-called incurable gastric diseases which have been allowed to go on to destruction of the glandular layer and absolute loss of peristalsis of the stomach are not incurable in themselves, but have become so from neglect, maltreatment, or procrastination. And even in those cases in which the practitioner is at present helpless, the rapid progress of medical art, especially as applicable to digestive diseases, promises a substantial gain in the near future.

Bibliography.— Hemmeter, 'Diseases of the Stomach,' in which there are 1,288 separate publications arranged categorically in separate chapters to which they refer especially, and over 1,000 references in the text; Ewald, 'Diseases of the Stomach,' translated into English by Morris Manges; Boas, 'Diagnostik und Therapie der Magenkrankheiten'; Riegel, 'Erkrankungen des Magens,' being Vol. XVI. of Nothnagel's 'Encyclopedia on special Pathology and Therapy'; Fleiner, Krankheiten der Verdauungsorgane'; Einhorn, 'Diseases of the Stomach'; Martin, 'Diseases of the Stomach'; Abercrombie, 'Investigations on Diseases of the Stomach'; Habershon, 'Diseases of the Abdomen'; Rosenheim, 'Pathologie u. Therapie des Verdauungsapparats'; Pick, 'Magenkrankheiten'; Brouardel et Gilbert, 'Traité de Médecine et de Therapeutique,' Vol. IV.; Mathieu, 'Traité de Maladies de l'Estomac'; Hemmeter, 'Organic Diseases of the Stomach'; Leo, 'Krankheiten der Bauchorgane'; Robin, 'Traité de Therapeutique appliquée,' fasc. XII. (article on indigestion by G. LeMoine). The modern literature of diseases of the stomach, intestine, liver, etc., up to 1904, is reviewed by John C. Hemmeter in 'Progressive Medicine,' December 1903, pp. 1–84.

JOHN C. HEMMETER, M.D., PH.D.,
Professor in University of Maryland.

Stom'ach-pump, a small pump or syringe used for removing matter from the stomach, for washing it out, or for injecting fluids into it. It resembles the common small syringe, except that there are two apertures near the end, instead of one, which, by means of valves in them opening different ways, serve respectively as a sucking and a forcing passage. When the object is to extract something from the stomach, the pump is worked while its sucking orifice is in connection with an elastic tube passed into the stomach; and the extracted matter escapes by the forcing orifice. When it is desired to throw cleansing water or other liquid into the stomach, the connection of the apertures and the tubes is reversed. A pump may not be always procurable when the occasion for it arises, and a simple tube will in many cases answer the purpose as well, if not better. If the tube be introduced, and the body of the patient be so placed that the tube forms a downward channel from the stomach, all fluid matter will escape from the stomach by it, as water escapes from a funnel by its pipe; and if the outer end of the tube be immersed in liquid, there will be, during the discharge, a siphon action of some force. On changing the posture of the body, water may be poured in through the same tube to wash the stomach. For washing out the stomach a long flexible tube is also in common use, water being run in by means of a funnel attached to one end, and this end being afterward lowered so as to form the tube into a siphon.

Stomata, minute orifices or pores in the epidermis of leaves, etc., which open directly into the air cavities pervading the parenchyma. See LEAVES.

Stomati'tis. See MOUTH, DISEASES OF THE.

Stone, Amasa, American business man and philanthropist: b. Charlton, Mass., 27 April 1818; d. Cleveland, Ohio, 11 May 1883. At 21 he engaged in the construction of railroad bridges and railroads, and soon attained high rank among constructors. In 1846 he entered into a partnership for the building of the Cleveland, Columbus & Cincinnati Railroad; in 1850 he was made president of that road and thenceforward resided in Cleveland. He was later engaged in the construction of the Cleveland & Erie Railroad; was managing director of the Lake Shore Railroad in 1872–4; and was president or director of several railroads and industrial corporations in Ohio. He gave largely to charitable institutions in Cleveland, and built and endowed an old ladies' home, and an industrial school. He also gave to Western Reserve University $600,000, on condition that the university should be moved from Hudson to Cleve-

Digitized by Google

land, and that the classical department should be named in memory of his son, Adelbert College.

Stone, Charles Pomeroy, American soldier: b. Greenfield, Mass., 30 Sept. 1824; d. New York 24 Jan. 1887. He was graduated from West Point in 1845; served in the Mexican War and was brevetted captain; was chief of ordnance of the division of the Pacific; and subsequently settled in California. At the opening of the Civil War he became an officer of volunteers in the Union army, but after a short term of service was arrested, and was imprisoned in Fort Lafayette, New York harbor, February–August 1862. Upon his release he served in the Department of the Gulf, and was chief of staff to Gen. Banks, 1863–4. Later in the year he resigned from the army. He entered the service of the khedive of Egypt in 1870, rose from brigadier-general and chief of staff to be Ferik-Pasha, 1873–83, received numerous decorations and held confidential positions under the khedive. Returning to the United States he became the engineer in charge of building the foundation for the Statue of Liberty in New York harbor.

Stone, Edward James, English astronomer: b. London 1831; d. Oxford 1897. He was graduated from Queen's College, Cambridge, and in 1860 was appointed chief assistant at the Greenwich Observatory. In 1870 he was made royal astronomer at the Cape of Good Hope, in which position he prepared a catalogue of all stars to the 7th magnitude between the south pole and 25° S. declination. This he supplemented in 1891 by a catalogue of all stars to the 7th magnitude between 25° S. declination and the equator. In 1879 he was appointed Radcliffe observer at Oxford, holding the position till his death. Among his contributions to astronomical science were his deduction of the value of the solar parallax and his observation of the reversal of the Fraunhofer spectrum during an eclipse of the sun in 1874.

Stone, Ellen Maria, American missionary: b. Roxbury, Mass., 24 July 1846. She was a member of the staff of the 'Congregationalist' at Boston in 1867–8, in 1878 went to Samokov as a Congregational missionary, and was removed subsequently to Philippopolis, southern Bulgaria, and (1898) Salonica, Macedonia. In September 1901 she was kidnapped by brigands between Bansko and Djumia, Macedonia, and a ransom of $110,000 for her and Mme. Tsilka, captured at the same time, was demanded. By subscription in the United States, $65,000 was raised and the release of the prisoners followed. Her narrative appeared as 'Six Months Among Brigands' in 'McClure's' in May–October 1902, and in 1903 in book form.

Stone, Frank, English painter: b. Manchester 22 Aug. 1800; d. London 18 Nov. 1859. He originally painted in water colors, and in 1837 became a contributor to the exhibitions of the Royal Academy. Subsequently for more than 20 years he produced many works in genre and history, and on subjects of sentiment and imagination. Some of these are well known by engravings, particularly the companion pieces entitled 'The First Appeal' and 'The Last Appeal,' once very popular. He was elected an associate of the Royal Academy in 1851.

Stone, James Samuel, American Protestant Episcopal clergyman: b. England 27 April 1852. He was graduated from the Philadelphia Divinity School 1877, took orders, and was ordained and was rector of St. Philip's Church, Toronto, 1879–82, of St. Martin's Church, Montreal, 1882–6, of Grace Church, Philadelphia, 1886–95, and of St. James' Church, Chicago, since 1895. He has published 'Simple Sermons on Simple Subjects' (1879); 'The Heart of Merrie England' (1887); 'Readings in Church History' (1889); 'From Frankfort to Munich' (1894).

Stone, Lucy Blackwell, American reformer: b. West Brookfield, Mass., 13 Aug. 1818; d. Boston 18 Oct. 1893. She was graduated at Oberlin College in 1847 and in 1855 was married to Dr. Henry B. Blackwell, retaining, however, her own name. In 1869 she helped organize the American Woman's Suffrage Association; became connected with the 'Woman's Journal' in 1872, and was editor after 1888. Her lectures on woman suffrage made her known throughout the country.

Stone, Marcus, English painter: b. London 4 July 1840. He is a son of Frank Stone, A.R.A. He learned his art in his father's studio; exhibited his first picture in 1858 in the Academy, of which he became an associate in 1877, being elected an academician in 1887. Among his better-known pictures are: 'Claudio Accuses Hero' (1861); 'On the Road from Waterloo to Paris' (1862); 'Stealing the Keys' (1866); 'Henry VIII. and Anne Boleyn' (1870); 'Sain et Sauf' (1875); 'Il y en a toujours un autre' (1882); 'A Gambler's Wife' (1885); and 'The First Love Letter' (1889).

Stone, Marvin Cheater, American inventor: b. Portage County, Ohio, 1842: d. Washington, D. C., 17 May 1899. He invented several small articles, and afterward discovered a method of imitating, in colored china, the famous "peach-blow" vase. He acquired a large fortune, and during his later years was engaged in many philanthropic undertakings.

Stone, Melville Elijah, American journalist: b. Hudson, Ill., 22 Aug. 1848. He began his journalistic career on the Chicago *Tribune*, but was not permanently settled in it until 1871, when he established the Chicago *Daily News*. In 1881, with Victor F. Lawson, he acquired the Chicago *Morning News*, changing its name to the *Record*. In 1888 he retired temporarily from newspaper work, and spent some years in Europe, and upon his return entered the banking business. In 1898 he became general manager of the Associated Press.

Stone, Ormond, American astronomer: b. Pekin, Ill., 11 Jan. 1847. He was graduated at the University of Chicago, and soon after was made assistant astronomer at the Naval Observatory at Washington. In 1882 he was appointed professor of astronomy and director of the observatory at the University of Virginia. He is the founder and editor of the 'Annals of Mathematics,' published by that institution, and a contributor to various scientific journals. He has made several important discoveries concerning nebulæ and double stars.

Stone, Thomas, American patriot, signer of the Declaration of Independence: b. Pointon Manor, Charles County, Md., 1743; d. 5 Oct.

Digitized by Google

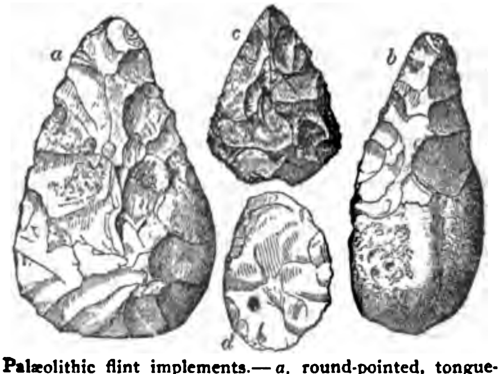
1787. He studied law at Annapolis, and began to practise at Frederickton in 1764. He was a delegate to the Continental Congress in 1775–7, and served as a member of the Committee on Confederation (1776–7); and in 1777 he urged Maryland to ratify the Articles of Confederation, which, however, the State did not do until three years later. In 1783–4 Stone was again a delegate to the Continental Congress, and in the latter year acted as president *pro tem.* Consult Sanderson, 'Signers of the Declaration of Independence,' Vol. IX. (1823–7).

Stone, William Leete, American historical writer: b. New York 4 April 1835; d. Mt. Vernon, N. Y., 11 June 1908. He graduated from Brown University in 1858 and in 1859 was admitted to the bar. He was centennial historian for New York and made the speech at Independence Hall, 10 May 1876. He published 'The Life and Times of Sir William Johnson, Bart.'; 'Revolutionary Letters'; 'History of New York City'; 'The Saratoga Battle Grounds'; 'Life of Gov. George Clinton'; etc.

Stone, Witmer, American naturalist: b. Philadelphia 22 Sept. 1866. He was educated at the University of Pennsylvania, and was assistant curator in charge of the museum of the Academy of Natural Sciences, Philadelphia. He has published 'Birds of Eastern Pennsylvania and New Jersey' (1894); 'The Molting of Birds'; etc.

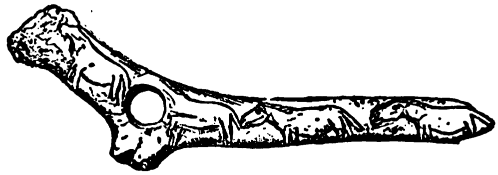
Stone. (1) A small piece or fragment of rock; a piece of rock adapted in size and shape for a specific purpose, as for building, etc. (See BUILDING STONE.) (2) In medicine, a calculous concretion in the bladder, kidney, etc. (See CALCULUS.) (3) A denomination of weight. See WEIGHTS AND MEASURES.

Stone Age, or **Age of Stone,** in archæology, a period in the history of a people when they employed as material for their cutting tools and weapons stone, they being unacquainted



Palæolithic flint implements.— *a*, round-pointed, tongue-shaped implement; *b*, acutely-pointed implement; *c*, arrow-head; *d*, irregularly ovate, sharp-rimmed implement.

with metallurgy; hence «stone age» is not significant of a definite period in chronology, but implies the time, longer or shorter, earlier or later, during which the people used stone weapons and tools. There are populations living in remote situations — in isles of the Pacific, or in the extreme north — who are still in their stone age: on the other hand, in the eastern hemisphere man had emerged from the stone age into the age of bronze and had thence advanced to a high state of culture many centuries before the Christian era. In Europe the progress of early culture was from the south and east to the north and west; hence the emergence out of the stone age was accomplished earlier in the south and east of Europe than in the north and west. The period of the stone age of European populations cannot be defined even approximately in terms of chronology. But in England, Belgium and France, and across the



Carved reindeer horn.

continent to the shores of the Mediterranean, the men of the stone age were contemporary with animals now either wholly extinct or locally extinct, as the mammoth, woolly rhinoceros, cave lion, cave bear, etc. It is an open question to what extent this change of fauna implies a change of climate; but from the geological conditions in which the flint implements of the rudest types occur it is evident that, though extensive changes must have taken place since they were deposited in the river basins, they all belong to the later deposits of the Quaternary period. The stone implements of Europe are divided into two classes — Palæolithic (or older stone) implements and Neolithic (or newer stone) implements. The palæolithic implements are rude in form, and are all of flint, manufactured by chipping only. But the neolithic implements are of finer forms, often highly polished, and made of many kinds of stone besides flint. The palæolithic implements are found in their original situation in the river gravels, in caves, and in association with bones of extinct animals; but the neolithic implements are found in the surface soil, in the kitchen-middens of ancient habitations, and in chambered tombs. Though the palæolithic flint implements are so roughly chipped that it is impossible to conjecture their specific uses, still they present many well-marked typical forms; some are chiefly flakes for cutting and scraping; there are pointed implements, almond-shaped or tongue-shaped. The flint implements from the caves present a greater variety of form, and are much more carefully finished. From the caves come also a series of implements of bone and of carvings on bone which, by their artistic character, contrast strongly with the extremely rude implements with which they are associated. The bone implements are well-made needles, awls, javelin or harpoon tips, and certain implements of reindeer horn regarded by French archæologists as instruments and emblems of rule — *batons de commandement* — which usually are carved in relief or ornamented with incised figures of animals and occasionally of human figures. The animals, for instance, a group of reindeer from the cave of La Madelaine, Dordogne, are drawn with wonderful faithfulness, freedom and spirit. The neolithic implements are axes and axe-hammers, knives, daggers, spear-tips and arrow-heads, saws, chisels, borers, and scrapers. The axes have usually no perforation for a haft;

Digitized by Google

they are simply wedges, the butt end of which was inserted in the shaft, or in a socket of stag's horn with a tenon on the upper and mortised into the shaft. Some of the long knives and daggers found in Denmark are marvels of skilful workmanship. The populations of the neolithic time deposited their dead in the chambers of dolmens. The pottery found in such sepulchres in Britain is generally of a hard-baked, dark-colored paste; and the vessels are mostly basin-shaped and round-bottomed; the ornamentation consists almost wholly of straight lines at various angles to each other. Neolithic man in Europe did not subsist on the products of the chase only; he practised agriculture and had the common domestic animals; these facts appear from the grains and seeds and the animal remains discovered in the haunts of these people. And the presence in the kitchen-middens of their sea-coast haunts of the remains of deep-sea fishes is proof that they possessed boats and fishing-lines.

Danish flint dagger.

Stone, Artificial, a concreted material applied to numerous purposes, as making building blocks, flagstones, tiles, statuary, vases, grindstones, sewer-pipes, etc. There are many varieties, most of which have a base of hydraulic mortar, with which sand and pulverized stone of different kinds are mixed. See CEMENT; CONCRETE; MASONRY.

Stone Circles, circles of standing stones and of small boulders, found throughout Great Britain and in some places on the continents of Europe, Asia, and Africa. See STANDING STONES.

Stone Coal, a name used to some extent in the United States and in England for anthracite coal to distinguish it from soft coal or bituminous coal. On the continent of Europe it is more frequently used to distinguish the older (Carbonic) coals from the later Mesozoic and Cenozoic coals and lignites.

Stone-crop, a plant, also called live-forever. See SEDUM.

Stone of Destiny. See LIA-FAIL.

Stone-fly, an aquatic neuropterous insect, much used as a bait in trout-fishing by anglers. These flies belong to the platypterous sub-order *Perlaria,* recognized by the hinder wings being of large size, and folded, while the tarsi are three-jointed, and the antennæ or feelers are filamentary in nature. The abdomen is provided with a pair of long-jointed caudal appendages. The mandibles are rudimentary. These flies and their larvæ occur plentifully in the neighborhood of lakes and ponds. They are carnivorous, and the larvæ are aquatic.

Stone-pine, a pine (*Pinus pinea*), common in the south of Italy, and often introduced into pictures of Italian landscapes. See PINE.

Stone River, or Murfreesboro. After the battle of Perryville (q.v.) 7-8 Oct. 1862, and Gen. Bragg's retreat from Kentucky into East Tennessee, Bragg was authorized by the Confederate government to make a movement into Middle Tennessee, and late in November had gathered his army at and near Murfreesboro, on Stone River, 33 miles southeast of Nashville. Wheeler's cavalry covered his front, its pickets within 10 miles of Nashville.

Gen. W. S. Rosecrans, who had succeeded Gen. Buell in command of the Army of the Ohio, 27 October, made some changes in the organization of the army, henceforth to be known as the Army of the Cumberland; which was composed of the Fourteenth Army corps. The corps was divided into three wings; the right wing, of three divisions, under Gen. A. McD. McCook, the centre of five divisions, under Gen. Geo. H. Thomas, and the left wing, three divisions, under Gen. T. L. Crittenden. On 26 December Rosecrans, with 56,000 men, advanced from Nashville in three columns, the right, under McCook, by the Nolensville pike, the centre, under Thomas, first on McCook's right by the Franklin pike and subsequently on his left; and the left, under Crittenden, by the Murfreesboro turnpike. Opposition was encountered from Wheeler's cavalry and Bragg's outposts at Nolensville, La Vergne, and Stewart's Creek bridge; and there was some delay caused by rain and bad roads; but at night of the 29th Crittenden was close up to Murfreesboro, and under Rosecrans' orders to occupy the place he threw a brigade across Stone River, two brigades were crossing the stream, and two divisions were under orders to follow, when the movement was suspended by Rosecrans, and the brigade recalled, after a sharp skirmish with a brigade of Bragg's troops. Thomas came up on Crittenden's right, but McCook was delayed until the next day, and after some severe fighting, in which he lost 135 killed and wounded, he took position on the right of Rosecrans' army, with his left, Sheridan's division, on the Wilkinson pike and with Davis' division on the right of Sheridan. At first R. W. Johnson's division was in reserve, but when McCook ascertained that the Confederate left overlapped him, Johnson was brought up on the right of Davis. Thomas rested his right, Negley's division, on the Wilkinson pike, connecting with Sheridan. Crittenden's left rested on Stone River, with his right across the Nashville and Murfreesboro pike connecting with Thomas.

Gen. Wheeler had promptly informed Gen. Bragg on the morning of the 26th that Rosecrans was on the march, upon which Gen. Hardee's corps was ordered in from Triune, and Wheeler was directed to protect its flank, impede the Union advance and, when hard pressed, fall back upon the main body of the Confederate army, which was to give battle in front of Murfreesboro. Hardee's corps, consisting of the divisions of Breckinridge and Cleburne, with John K. Jackson's brigade as a reserve, made up Bragg's right wing; its right rested on the Lebanon pike, north of Murfreesboro, its left on the Nashville road. Wheeler's cavalry was on the right. Polk's corps — the divisions of Withers and Cheatham—was on Hardee's left, connecting with it on Stone River; McCown's division of E. Kirby Smith's corps, which at first was held in reserve east of the river, was ordered on the night of the 29th to cross over and extend Polk's left; so, on the night of the 30th, Hardee's corps was east of Stone River and Polk's corps and McCown's division west of it. The two armies bivouacked opposite each other; west of the river they were

Digitized by Google

not over 500 yards apart. Rosecrans had on his rolls 56,000 men, of whom 43,400 were to become engaged; Bragg 51,000, of whom 37,700 were to be carried into action.

While Rosecrans was taking position on the 30th Wheeler's cavalry was raiding his rear. Wheeler, with seven regiments of cavalry and a part of a battery, started from Bragg's right, on the Lebanon pike, about midnight of the 29th, crossed Stone River at Jefferson, after daylight, and attacked Starkweather's brigade, by which, after a sharp fight, he was repulsed, with a loss to Starkweather of 122 men, most of them prisoners, but he captured and burned part of the brigade train. He then marched for La Vergne, picking up stragglers and burning wagons, and reaching La Vergne at noon of the 30th, attacked and captured the immense supply-train of McCook's command, which he burned, took and paroled over 700 prisoners and, pushing on to Rock Spring, attacked, captured and destroyed another large train. He then marched to Nolensville, capturing large trains, stores, and arms, and about 300 prisoners, who were paroled; halted near Nolensville for a short rest; and at 2 A.M. of the 31st resumed his march and joined the left of the army, then engaged. He had made a complete circuit of the rear of Rosecrans' army, had taken and paroled over 1,000 prisoners, and destroyed over $1,000,000 worth of stores, leaving miles of road strewn with burning wagons. He brought back with him nearly 5,000 stand of small arms.

According to Rosecrans' plan of battle, McCook was to hold fast on the right and keep back Bragg's left in his front, while Thomas and the right division of Crittenden were to open the battle on the morning of the 31st with skirmishing, and to engage Bragg's centre and left as far as the river, and Van Cleve's and Wood's divisions of Crittenden's wing were to cross Stone River and attack Bragg's right, to drive it back through Murfreesboro, and into the open country toward Salem. Thomas was to take up the movement on Crittenden's right. The attack was to commence at 7 A.M.; Van Cleve's and Wood's divisions had been massed on the left; Van Cleve's skirmishers had crossed the stream, and one of his brigades had followed and formed line and the rest were in motion, when the roar of battle came up from the right, the movement on Bragg's right was abandoned, Van Cleve was recalled, and Rosecrans was obliged to yield his plan of battle to one laid down by Bragg.

Bragg had determined to attack and turn Rosecrans' right at daybreak, and for that purpose, leaving Breckinridge's division to hold the right against Rosecrans' left, Hardee was ordered to march Cleburne's division from the right to the left, take command of that and of McCown's division, and open the fight at daybreak by an attack upon McCook's right. Hardee's attack was to be followed up by Polk's divisions in succession to the right, the move to be made by a constant wheel to the right on Polk's flank on the river, as a pivot, the object being to force Rosecrans back on Stone River, gain the roads in his rear, and cut him off from his base of operations and supplies by the Nashville pike. On the night of the 30th Hardee led Cleburne's division to the left and placed it in rear of McCown. At daybreak McCown advanced and fell upon the right of R. W. Johnson's division while the men were preparing breakfast. The skirmishers had seen the advance and had resolutely opposed it, while the main line was preparing to meet the shock. The skirmish-line was driven in by the impetuous Confederate advance, and McCown, swinging to the right, overlapped Johnson's right, soon overcame the two brigades holding the first line, captured most of their artillery, and swept them from the field. McCown's first movement had diverged somewhat to the left, leaving an opening between his right and the left of Wither's division, into which Cleburne's division sprang, and then advanced on Davis' division, and it was severely engaged with Davis when Johnson gave way, upon which McCown turned one of his brigades upon Davis' flank. Davis changed front on his right, to meet McCown, made counter attacks upon Cleburne in his front, and repulsed some of Cleburne's fierce assaults, but was finally forced back with great loss, with a part of Sheridan's division on his left. Sheridan also changed front to meet attacks upon his flank; but after desperate fighting, making three successive stands and repulsing some furious assaults, he was obliged to fall back upon the divisions of Negley and Rousseau of Thomas' command, on the left of the Wilkinson pike; and upon those and Sheridan, Polk's two divisions of Withers and Cheatham fell with great force, attacking them in front, left flank, and rear, causing them to fall back in rear of Crittenden's line. The entire right and centre of the Union line had now been driven back beyond the Wilkinson pike, and Rosecrans made heroic efforts to stem the tide setting against him and hold the Nashville pike, his only remaining connection with Nashville, and on which were all his trains. Everything was rallied on a new line covering this road, and Van Cleve's division of Crittenden's wing was brought up. There was another fierce struggle, but the Confederate attack was repulsed, with Rosecrans' right and centre thrown back at a right angle to its position of the morning, and with Bragg's line also at a right angle to his original line, the left of Rosecrans and the right of Bragg resting on Stone River. It was now past noon; Bragg held a large part of the field, with many prisoners, guns, wagons, and ammunition, and the dead and wounded of both armies; but Rosecrans still held the road to Nashville. Bragg had made persistent efforts to crush the left of the Union line, where it rested near Stone River, and Polk's corps had been bloodily repulsed in several assaults on that part of the Union line. Another effort was now made. At 10 A.M. Bragg had ordered Breckinridge to send one brigade and, soon after, a second to reinforce Hardee; but when Bragg was informed that Rosecrans' left was crossing the river to attack Breckinridge the order was countermanded. It was ascertained that the information of an attack upon Breckinridge was incorrect; upon which Bragg ordered Breckinridge to send two brigades to report to Hardee, and soon after gave him a second order—to leave one brigade east of Stone River and march with the rest of his command to Hardee's support. When the brigades of Adams and Jackson crossed Stone River Hardee

Digitized by Google

had been checked and thrown back, and the two brigades were sent to Polk, who was still assailing Rosecrans' left. The two brigades, the right of their line resting on Stone River, went forward, relieved part of Cheatham's, and became hotly engaged, but were driven back with great slaughter, some regiments losing more than half their men. As they were falling back Breckinridge came up with the brigades of Preston and Palmer, which were sent forward and speedily repulsed. Cannonading continued until nightfall, when, exhausted by a conflict of full ten hours' duration, rarely surpassed for its continued intensity and the heavy losses sustained, both armies sank to rest.

While Bragg's infantry and artillery were breaking the Union lines and forcing them back, his cavalry under Gen. Wharton, with part of McCown's infantry were engaged on Rosecrans' right and rear, inflicting losses in killed and wounded, capturing guns and wagons, and taking nearly 2,000 prisoners.

Rosecran's losses during the day had been appalling, and when night came he was in some doubt whether to remain on the field. He says: «After a careful examination and free consultation with corps commanders, followed by a personal examination of the ground in rear as far as Overall's Creek, it was determined to await the enemy's attack in that position, to send for the provision train, and order up fresh supplies of ammunition, on the arrival of which, should the enemy not attack, offensive operations were to be resumed.» There was a readjustment of the line, the left was drawn back, though still resting on Stone River, and the right and centre grasped more firmly the Nashville road. On the morning of 1 Jan. 1863 Bragg began to demonstrate with infantry and artillery, and again Wheeler's and Wharton's two brigades of cavalry sought the rear of the Union line. They attacked a large train near La Vergne, capturing part of it and a piece of artillery, and informed Bragg that heavy trains were moving toward Nashville, some loaded; and all the ambulances filled with wounded. Early in the morning Van Cleve's division, commanded by Col. S. Beatty, supported by Grose's brigade, was thrown across the river from the left, and formed line on a hill in front of Breckinridge, who had resumed his position on that side, on Bragg's right. During the morning of the 2d there was quiet along the lines except on Rosecrans' left, where there was some shelling, but there were indications that Bragg was meditating an attack upon Rosecrans' left, and preparations were made to meet it, Davis' division being ordered from the right to the left and some changes made on that flank. From his headquarters west of the river Bragg had seen that Polk's line could be enfiladed by artillery placed on the hill occupied by the right of Van Cleve's division, and after noon Breckinridge was ordered to take the hill and occupy it with his artillery. The two brigades that yet remained west of Stone River were returned to Breckinridge, and he was reinforced by 2,000 of Wharton's and Pegram's cavalry and some artillery. Breckinridge formed his division in two lines, two brigades in each, with two batteries of artillery in rear. He had, excluding the cavalry, which came too late to take an active part, about 4,500 men. The distance to be traversed was about 1,600 yards. At 4 P.M. the signal-gun was fired, and the four brigades advanced to the attack. After a severe fight the two right brigades of Van Cleve's division were broken and driven from the hill and toward the river. Bragg's order had been fully obeyed, but the Confederates, exultant with success, did not stop at the hill, but pursued the broken Union fragments, and as they neared the river a few of them crossed it. Major John Mendenhall, who had hurriedly massed 58 guns on a commanding position on the west bank of the river, opened fire with all the guns upon the somewhat massed column, the infantry added their fire, and Breckinridge's attack was repulsed. That part of Van Cleve's line that had not been driven across the river attacked the fleeing Confederates, a Union brigade, without orders, crossed the river in pursuit, and the Confederates were driven back to the position from which they had advanced with a loss of four guns and over 1,700 killed and wounded of the 4,500 engaged. It was night and Davis' and Woods' divisions were sent across and intrenched on the hill that had been the point of contention. A cold and heavy rain-storm marked the 3d, and, fearing a rapid rise in the river, Rosecrans withdrew all his troops from the eastern side of it. No other movement was made on the lines, the day passed in comparative quiet, and at night Bragg, under the erroneous impression that Rosecrans was receiving reinforcements, marched for Tullahoma, 36 miles distant. The 4th was occupied by Rosecrans in burying the dead, and on the 5th his army occupied Murfreesboro. The Union loss in the battle, including 53 killed and 259 wounded in minor engagements between Nashville and Stone River, was 1,730 killed, 7,802 wounded, and 3,717 missing, an aggregate of 13,249. The Confederate loss was 1,294 killed, 7,945 wounded, and about 2,200 missing. Consult, 'Official Records,' Vol. XX.; Van Horne, 'History of the Army of the Cumberland,' Vol. I.; Stevenson, 'Battle of Stone River'; The Century Company's 'Battles and Leaders of the Civil War,' Vol. III.

E. A. Carman.

Stone Worship, a form of fetishism which has persisted in the religions of some cultivated races. The ancient Germans and Gauls paid reverence to stones: St. Eligius (Eloi), bishop of Noyon, exhorts his Frisian converts against this practice: «Let no Christian presume to set lights or to say prayers (*reddere vota*) at fanes or rocks or fountains or trees:» and throughout the Middle Ages the Church never ceased to condemn the practice of addressing prayers or vows to stones — *votum vovere ad lapidem vel ad quamlibetrem*. All the great nations of antiquity worshipped stones: at Pharæ in Achaia, according to Pausanias, 30 square stones were worshipped; and he adds that in earliest times «rude stones, instead of images, received divine honors.» Meteorites have ever been special objects of worship: such was the stone symbol of Diana at Ephesus, of the sun-god at Emesa in Syria, of Mars at Rome; such too was the Kaaba at Mecca. As stones are in India set up standing in groups as representing deities, Tylor conjectures that menhirs, cromlechs, and dolmens may have had a like signification.

Digitized by Google

Stone'chat, a small and pretty European non-migratory bird (*Motacilla rubicola*), closely related to the American bluebird and the familiar English wheat ear. It is chiefly terrestrial in its habits.

Stoneham, stōn'am, Mass., town in Middlesex County; on the Boston & Maine Railroad; 11 miles north by west of Boston. It was incorporated and became independent of the adjoining towns, in 1725. It has several large manufacturing establishments, among which are boot and shoe factories, machine shops, box-factory, tanneries, and a furniture factory. It has a number of fine residences, six churches, 23 elementary school buildings, a high school, and a public library. There are a national and a savings bank; the national bank has a capital of $50,000. Pop. (1910) 7,090.

Stonehenge, stōn'hĕnj, a notable example of the ancient stone circles, situated in Salisbury Plain, Wiltshire, England, about seven miles north of Salisbury and within two miles of the town of Amesbury. The structure consists of two concentric circles of upright stones surrounding two concentric ellipses, the whole surrounded by a double earth wall and ditch, about 370 yards in circumference. There is an entrance at the northeast which proceeds in the form of an avenue, guarded on each side by a wall and a ditch, for a distance of 594 yards, after which it divides, one branch going eastward up a hill, between two groups of burial mounds or barrows, and the other branch leading northwest to the cursus or race-course, about 300 yards distant. The outer earth-wall is 15 feet high, the ditch 30 feet wide, and the avenue, at the entrance, 15 feet wide. The outer circle is about 105 feet in diameter, and consisted when complete of 60 stones, 30 uprights, and 30 horizontal imposts between them. The upright stones are about 16 feet high, and six or seven feet thick. Of the original 60 there remain 32 stones, being 17 uprights in position, seven prostrate, and eight imposts. At the avenue entrance there are 11 uprights remaining with five imposts. The uprights of the outer circle were placed about four feet apart, with the imposts fitted to them continuously at their top, each upright bearing a vertical peg at each side, into which fitted a mortise in the end of the horizontal impost. The imposts are on an average about 10 feet long, 3½ feet wide, and 2 feet 8 inches deep. There is a space between the outer and the inner circles of from 8 to 9 feet forming a walk 300 feet in circumference. The number of uprights composing the inner circle has been stated variously, the different figures ranging from 40 to 60; there were no imposts in the inner circle and the height of the stones, judging from the 11 still standing, seems to have been about six feet. This circle, like the first, has an opening to the northeast, opposite the entrance. But unlike the outer circle, it is composed, not of hewn sandstone, but of smaller rocks, seemingly boulders brought from a distance. Within the inner circle and about the same distance from it as the outer circle stands the first oval, an incomplete oval, in the shape of a huge horse-shoe with its open end facing the entrance at the northeast. The first oval consists of five groups or trilithons, each trilithon being composed of two uprights with an impost at the top completely covering their upper edges. The five trilithons are thus independent and not connected by continuous imposts. Their size gradually rises from east to west, the largest being the grand central trilithon in the closed end of the ellipse, and the smallest, about 16 feet high, those nearest the entrance. The height of the central trilithon, with impost, is 28 feet, the pillar stones being about 23 feet above ground, and the impost about four feet thick. Other dimensions of this trilithon are: Length of impost, 15 feet; breadth, 4½ feet; breadth of uprights, 7½ feet; thickness, 4 feet. The other four trilithons stood two and two facing each other. Only two of these five groups are now perfect. One of the pillars of the central trilithon, fallen, is broken into three pieces; the impost though fallen is intact, and the remaining upright is nine feet out of the perpendicular. Of the two trilithons of the west side the one nearer the centre fell outward, entire, in 1797; though prostrate the stones are intact. The other trilithon on the west broke up at an earlier date; one of its pillar stones remain standing — the other and the impost lie at its foot, broken. The trilithons of this, the outer ellipse, are of hewn sandstone like the stones in the exterior circle. Within this outer ellipse is a smaller one of the same shape, wth the opening facing the northeast, but, like the inner circle, composed not of tool-dressed sandstone, but of bluestone boulders, and, also like the inner circle, without imposts. The stones employed in the smaller ellipse are on an average about a foot to a foot and a half taller than those in the smaller circle; they are set at intervals of about five to six feet. Within the inner oval, at its upper end, in front of the central trilithon, is a slab of coarse-blue marble, 16 feet long, 4 feet broad, and 20 inches thick. This is commonly spoken of as the altar stone. The cursus at the end of the western branch of the avenue of approach is a stretch of flat land, about 1¾ miles long and 110 yards across. It is bounded by parallel banks and ditches and is rectangular in shape, with a flat mound stretching across its eastern end. There is a smaller cursus a little to the north and barrows lie all around. Within the avenue of approach there is a large upright which has been nicknamed the Friar's Heel. It is 16 feet high and is supposed to be a bowing-stone.

The purpose of Stonehenge, its time of erection, and the race or races which built it, will probably never be known with certainty. Despite the efforts of the numerous archæologists who have given it their attention, nothing in the nature of proof has been found for anyone of the various theories. It is generally accepted as an extraordinary development of the stone circles (q.v.) found throughout Great Britain and in parts of France and Scandinavia. For a long time these circles were known as Druidical Rings, and Stonehenge was regarded as probably the head temple of Druidical worship. This theory, however, has been discredited recently on account of the discovery that many other of these monuments, also supposed to be of Druidical origin, were of a sepulchral nature. The circular form of the monument has suggested to some writers that it was connected with a worship of the sun. By others it has been at-

Digitized by Google

tributed to the Phœnicians, the Belgæ, the Saxons, and the Danes. It has been called a martial court of justice — a battle ring for judicial combatants — a shrine to Buddha, a temple to serpent worship, and a monument of victory. The theory most widely accepted is that it is a burial ground or a temple connected with burial ceremonies for some ancient people who inhabited at some time the greater part of Great Britain and who either emigrated from or to the shores of France and Scandinavia. The fact that Stonehenge is the centre of a region numerous in barrows, and that this is true of all the other great stone circles or standing stones seems to bear out the likelihood of its connection with the burial ceremony. Sir John Lubbock assigns its date as that of the Bronze Age, basing his beliefs on the character of the contents found in the surrounding barrows and upon the evidences of tool-work upon the stones of the outer circle and outer ellipse. This latter fact, however, is interpreted by others merely as an indication that the other portions of the structure are of much older date.

Stonehenge is first mentioned in the 9th century by Hennius, who states that it was erected in the 5th century by Ambrosius, the last Briton king, aided by the magician Merlin, to commemorate the 460 Briton nobles who were treacherously murdered at that spot by Hengist, the Saxon. This legend is repeated by Henry of Monmouth in his 'Historia Britonum,' in the 12th century, and then by numbers of the historians of the Middle Ages. The first history of Stonehenge, written by Inigo Jones and published in 1655, speaks of the structure as a Roman temple and deprecates its demolition by the country-folk of the neighborhood, who removed portions of the fallen stones to build bridges, make mill-stones and for such like uses. (See STONE CIRCLES.) Consult: Davies, 'Celtic Researches' (1804) and 'Mythology of the Druids' (1809); Gidley, 'Stonehenge Viewed in the Light of Ancient History,' etc. (1877); Sir Henry James, 'Plans and Photographs of Stonehenge' (1867); Long, 'Stonehenge and its Barrows' (1876); Sir John Lubbock, 'Prehistoric Times' (ed. 1898); and William Stukeley, 'Stonehenge and Abury' (1840).

Stoneman, stōn'mạn, **George**, American soldier: b. Busti, N. Y., 8 Aug. 1822; d. Buffalo, N. Y., 5 Sept. 1894. He was graduated at West Point in 1846, served on the Pacific coast (1847–57), in 1855 was promoted captain, and until 1861 was on duty mainly in Texas. Early in 1861, while in command of Fort Brown in that State, he was ordered by Gen. Twiggs to surrender to the Confederates. He refused, evacuated the fort, and with his men sailed by steamer to New York. In August 1861 he became brigadier-general of volunteers and chief of cavalry in the Army of the Potomac, and commanded the cavalry in the Peninsula Campaign of 1862 (q.v.), distinguishing himself at the battle of Williamsburg (q.v.). In November 1862 he was promoted major-general of volunteers, having already been placed in command of the Third Corps, which he led at the battle of Fredericksburg. He led a cavalry raid toward Richmond during the Chancellorsville campaign. In April 1864 he took command of a cavalry corps in the Army of the Ohio, and during the Atlanta campaign made another notable raid (see STONEMAN'S MACON RAID). At Clinton, Ga., he was captured in July 1864, and for three months was kept a prisoner. In December 1864 he made his third important raid (see STONEMAN'S RAID FROM EAST TENNESSEE INTO SOUTHWESTERN VIRGINIA); and in the following March he entered upon still another of these remarkable incursions into Confederate territory. (See STONEMAN'S RAID IN EAST TENNESSEE, SOUTHWEST VIRGINIA, AND WESTERN NORTH CAROLINA.) In 1871, having received several brevets in the regular army, he retired from the service and settled in California, where for six years he served as a railroad commissioner, and from 1883 to 1887 was governor of the State, to which office he was elected by the Democratic party.

Stoneman's Macon Raid. When Gen. Sherman was operating against Atlanta he ordered all his available cavalry to prepare for a blow at the Macon Railroad, simultaneously with the movement of the Army of the Tennessee toward East Point. Gen. Stoneman, with 5,000 cavalry, was to move by the left around Atlanta to McDonough, and Gen. E. M. McCook with two divisions of 3,500 men, by the right on Fayetteville; and on the night of 28 July 1864 Stoneman and McCook were to meet on the Macon Railroad, near Lovejoy's Station, and destroy it in the most effectual manner. On the morning of the 27th both columns started. McCook on the right, with 3,200 men and 8 guns, marched down the west bank of the Chattahoochee, laid a pontoon-bridge near Riverton and crossed, and moving on Palmetto Station, on the West Point Railroad, tore up some two miles of the track, and went on to Fayetteville, where he captured about 250 prisoners, 500 wagons, which he burned, and 800 mules, a greater part of these he killed, and then pushed on to the Macon Railroad at Lovejoy's Station, about seven miles below Jonesboro, and 30 from Atlanta. He hoped here to meet Stoneman, but heard nothing of him, destroyed the depot, the railroad to some extent, burned army trains, and was prosecuting his work in the destruction of the road, when he was driven off it by a considerable Confederate force, and still hearing nothing from Stoneman, endeavored to return and recross the Chattahoochee by marching southwest, and had reached Newnan, on the West Point Railroad, on the 30th, where he encountered an infantry brigade, coming from the south and at the same time was attacked in rear by Jackson's division of Wheeler's cavalry, soon reinforced by Wheeler himself with two additional brigades. McCook had several hard encounters, in some of which he was successful, but was forced to let loose his prisoners, about 400 in number, abandon his artillery and trains, and cut his way out, each brigade commander looking out for himself, and succeeded, with parts of his command, in reaching the Chattahoochee, which he crossed and marched to Marietta, with a total loss of about 600 men. Stoneman at the moment of starting had received Sherman's permission after the completion of his work at Lovejoy's, to march on Macon and Andersonville and release the thousands of Union prisoners, at these places. Marching on the morning of the 27th, he left Garrard's division at Flat Rock, and with the brigades of Cols. Adams, Biddle and Capron, in all about 2,200 men,

Digitized by Google

crossed the Ocmulgee River, near Covington, and made for the railroad running from Macon to Augusta, on which he destroyed a large number of engines and cars at Gordon and Griswoldville. A detachment went eastward and burned the bridge over the Oconee. Stoneman reunited his detachments near Macon, on the 30th, but the river was between him and the city, and he contented himself with shelling the place and then moved back toward Clinton. Meanwhile he had heard that the prisoners had been removed. Gen. Iverson's cavalry division had been ordered by Wheeler to follow Stoneman, and was now upon him. On the morning of the 31st Stoneman, finding what he supposed to be a heavy Confederate force in his front, deployed a strong line of skirmishers, which soon developed the fact that Allen's brigade of Confederate cavalry had passed around his flank and taken up a strong position directly across his line of retreat, while Armstrong's brigade, co-operating with Allen's, was closely menacing his left flank. Dismounting the men of one brigade he repeatedly charged the Confederates, but every charge was repulsed with heavy loss, and Armstrong followed by a charge upon his left flank. The Union line gave way and was with difficulty rallied and reformed. By this time he was nearly surrounded, and as he mistakenly thought by a greatly superior force. Believing further resistance useless, he authorized his brigade commanders to cut their way out, while he, with a regiment and a section of artillery, held the enemy in check until the others got through, when he surrendered about 500 men. The greater part of Adams' brigade escaped and joined the army near Atlanta. Capron's brigade escaped, but was subsequently surprised and scattered, very few getting back to the Union lines. Consult: 'Official Records,' Vol. XXXVIII.; Van Horne, 'History of the Army of the Cumberland,' Vol. II.; Sherman, 'Personal Memoirs,' Vol. II.

E. A. CARMAN.

Stoneman's Raid from East Tennessee into Southwestern Virginia. After the defeat of Gen. Gillem's Union brigade at Russelville, Tenn. (q.v.), 14 Nov. 1864, Gen. Thomas, commanding the Military Division of the Mississippi, of which East Tennessee was a part, ordered Gen. Stoneman to concentrate his forces in Kentucky and advance from Lexington to Cumberland Gap to oppose Gen. Breckinridge should he attempt to move into Kentucky, and to advance into East Tennessee and drive Breckinridge back into Virginia or North Carolina. Thomas' instructions were "to concentrate the largest possible force against Breckinridge, and either destroy his force or to drive it into Virginia and, if possible, destroy the salt-works at Saltville, and the railroad from the Tennessee line as far into Virginia as he could go without endangering his command." These instructions were repeated by Thomas on 6 December, when it was known that Breckinridge was on the retreat. By the 9th Stoneman had completed the organization of his command and was ready for operations in the field. He had a body of mounted troops, under Gen. Burbridge, that had been doing duty in Kentucky, the Tennessee brigade of Gen. Gillem, and some infantry and dismounted cavalry under Gen. Ammen, in all a force of 8,000 men. The 4th Tennessee and 3d North Carolina (Union) regiments were sent to Paint Rock to hold the pass over the mountains into North Carolina, and Stoneman concentrated his command at Bean's Station on the 11th. Stoneman started from Bean's Station on the 12th, with Gillem's and Burbridge's commands of about 5,700 men, and Gillem, in advance, reached the north fork of the Holston River, opposite Kingston, during the night, crossed after a sharp engagement, and early in the morning of the 13th attacked and routed Duke's cavalry under Col. Morgan, capturing Morgan and 80 of his men and his entire wagon-train. During the day Burbridge pushed on to Bristol, to intercept Gen. Vaughn, who had been holding Greeneville with some 1,200 men. Stoneman, with Gillem, joined Burbridge at Bristol early on the 14th, and fearing that Vaughn would pass in the night and join Breckinridge at Saltville or in the vicinity, Burbridge was pushed on to Abingdon, with instructions to send the 12th Kentucky cavalry forward to strike the railroad between Saltville and Wytheville to prevent the former place from being reinforced by troops from Lynchburg. The 12th Kentucky, after threatening Saltville, struck the railroad and cut off two trains that had brought Breckinridge with a battery and reinforcements from Wytheville, accomplishing its object. Stoneman now decided to push on to Wytheville, destroy that place and the salt-works on New River, and attend to the capture of Saltville on his return. He moved early on the 16th and Gillem overtook Vaughn at Marion, attacked and routed him, pursuing to Wytheville, capturing his trains, artillery and 198 men, and destroying the town. About midnight Burbridge's command was put on the road, and reached Mt. Airy at daylight of the 17th, where Col. Buckley's brigade was detached to destroy the lead-mines 25 or 30 miles beyond, in Wythe County, which was accomplished without loss. Having destroyed the railroad and bridges some distance beyond Wytheville, Stoneman now set out on his return to destroy the salt-works at Saltville, and on the 17th encountered Breckinridge in a strong position at Marion. He had moved out of Saltville with all the troops he could collect that had been operating in East Tennessee, and had not far from 2,000 men. With these he had proposed to follow Stoneman and attack his rear. He now stood in the path of his return. Burbridge, who was in the advance with two brigades, engaged him and called upon Stoneman for reinforcements; and Stoneman, riding forward, took the command in his own hands. Night soon came on, the troops had become disarranged, and a general attack was delayed until morning, when it opened with great spirit, Stoneman meeting with a stiff resistance and some loss, and making no headway. Buckley was supposed to be coming up in the afternoon, and Gillem, now up, was sent around Breckinridge's left, thus cutting him off from the salt-works. The skirmishing during the day was accompanied with considerble loss on both sides, and as soon as night set in Breckinridge finding himself cut off from Saltville, and nearly surrounded, withdrew by the road leading over the mountains into North Carolina and escaped. The 12th Ohio cavalry was sent in pursuit, capturing some abandoned wagons and caissons,

Digitized by Google

and then returned; and that night Stoneman concentrated his command at Glade Springs. At daybreak of the 20th Stoneman advanced on Saltville in two columns, Burbridge to enter the place on the north, Gillem on the south. Gillem arrived first and waited for Burbridge, who was not in position, and night coming on and nothing yet accomplished, Col. Stacy, with the 13th Tennessee cavalry, was ordered to make a detour to the left and dash into the town. Stacy carried out his orders to the letter. He dashed into the town, set part of his regiment to work in burning it and with the remainder charged the fortifications, held by 400 men under Col. Preston, went over them, dispersing Preston's men, and capturing two guns and a number of prisoners without the loss of a man. Stoneman says the charge "was a signal for a general stampede of the enemy, and by 11 o'clock in the night all the works were evacuated and in the possession of Col. Stacy, and the town of Saltville was in flames." All day and night of the 21st was devoted to the destruction of the salt-works and all the machinery, and on the 22d Stoneman began his return march, Burbridge going by way of Big Sandy to Kentucky, and Gillem to Knoxville by Poor Valley and the west side of Holston River. Stoneman reports that he captured 34 officers and 845 men, 19 guns, 3,000 horses and mules, great quantities of ammunition, and from 50,000 to 100,000 bushels of salt, and that he destroyed the towns of Bristol, Abingdon, Wytheville, and Saltville, 13 railroad trains, with engines attached, several trains without engines, all the depots of supplies in Southwest Virginia, and railroad depots, foundries, mills, storehouses, turnpike and railroad bridges, but that the greatest loss inflicted was the destruction of the lead-works 17 miles from Wytheville and the salt-works at Saltville. A Confederate writer says: "The damage inflicted upon Southwest Virginia by this Federal raid, in the destruction of railway and turnpike bridges, railway stations, and warehouses, ironworks, woolen mills, lead-works, and army supplies of all kinds was very injurious to the Confederacy, greatly crippling its defensive power in that region, and was also a serious blow to the Army of Northern Virginia by depriving it of supplies from that great storehouse of agricultural wealth." Consult: 'Official Records,' Vol. XLV.; Van Horne, 'History of the Army of the Cumberland,' Vol. II.

E. A. Carman.

Stoneman's Raid in East Tennessee, Southwest Virginia and Western North Carolina. Early in February 1865, Gen. Grant directed Gen. Thomas to send an expedition under Gen. Stoneman from East Tennessee to penetrate North Carolina and well down to Columbia, S. C., to destroy the enemy's railroads and military resources in that section and visit a portion of the State beyond the control or reach of Sherman's column, which had started on its march northward from Savannah. On the 27th Grant wrote that Stoneman was to repeat the raid of the previous fall, destroying the railroad as far toward Lynchburg as he could. As the movement was merely for the purpose of destruction, Stoneman was to avoid any heavy engagement. Stoneman's force, which was concentrated at Mossy Creek, East Tennessee, 22 March, consisted of the cavalry division of Gen. A. C. Gillem, three brigades of three regiments each, under Cols. W. J. Palmer, S. B. Brown, and I. K. Miller, numbering about 6,000 men. It had now become known that Sherman had captured Columbia, S. C., and there were rumors that Lee's army would evacuate Petersburg and Richmond, with the possible intention of moving by way of Lynchburg to Knoxville; and Stoneman was therefore directed to move toward Lynchburg, give his first attention to the destruction of the railroad, and then sweep through western North Carolina. On the 24th Stoneman moved to Morristown, and sent Miller's brigade to cut off a Confederate force between Jonesboro and Carter's Station, but the force escaped, and on the 26th Miller rejoined Stoneman, who had advanced to Jonesboro. All incumbrances were thrown aside, and with but four guns, and two ambulances to accompany the column, Stoneman left Jonesboro on the 26th and, crossing Iron Mountain, arrived at Boone, N. C., on the 28th, where he captured a body of homeguards, and the column was divided marching by two different routes across the Blue Ridge and through Wilkesboro, Jacksonville, and Mt. Airy, N. C., and Hillsville, Wytheville, Christianburg, and Salem, Va., to within four miles of Lynchburg, destroying bridges and railroad track, capturing trains and prisoners, and causing the Confederates to abandon many guns. This was accomplished by 6 April, at which time Stoneman had possession of 90 miles of the Virginia Central Railroad, from Wytheville nearly to Lynchburg. The bridges over Roanoke and New rivers were destroyed, and on the 9th the entire command arrived at Danbury, N. C. Next day at Germantown, beyond Danbury, Palmer was detached and ordered to Salem, N. C., where he destroyed the extensive factories which were supplying the Confederate armies with clothing, then destroyed the railroad south of Greensboro, and also a part of it between that place and Danville, Va. The main column moved toward Salisbury, dispersing small bodies of the enemy, and bivouacking on the night of the 11th 12 miles north of that place. At midnight the march was resumed, and the South Yadkin River crossed, and at daybreak the Confederate pickets were driven in and across Grant's Creek two miles from Salisbury. The bridge across the creek was defended by 18 guns, under command of Col. J. C. Pemberton (formerly a lieutenant-general) and about 3,000 men, commanded by Gen. Gardener. The flooring of the bridge had been taken up. Detachments were sent up and down the stream to cross and come in on the Confederate rear; and time being given for this, a charge was made on the bridge, the men went over on the stringers, and the Confederates were totally routed and pursued through Salisbury, Stoneman capturing the 18 guns, 1,364 prisoners, 10,000 stand of arms, and some wagons. At Salisbury an immense amount of public property was destroyed, and the railroad was wrecked for several miles south of the place. Having raided over 500 miles, destroying railroads, and capturing horses enough to refit his entire command, Stoneman concluded to take the prisoners and the captured artillery not destroyed to East Tennessee. He withdrew from Salisbury, on

Digitized by Google

the 13th, and reached Lenoir on the 15th, where he turned over the command to Gen. Gillem and, with a strong escort, conducted the artillery and prisoners to Tennessee. His instructions to Gillem were to scout on the east side of the Blue Ridge; to put Palmer's brigade at Lincolnton to scout down the Catawba; Brown at Morgantown, to connect with Palmer on the Catawba; and Miller, at Asheville, to open communication through to Greeneville, Tenn. When Gillem, with the two brigades of Brown and Miller, reached the Catawba, 2½ miles from Morgantown, the bridge was found to be torn up, the ford blockaded, and the passage of the river disputed by Gen. McCown with about 300 men and one gun. A flanking force was sent up the stream about two miles, crossed, and gained McCown's rear; the force in front attacked with artillery; and the infantry, crossing on the sleepers of the bridge, charged McCown and routed him, killing some of his men, and capturing his gun and about 50 prisoners. On the 19th Gillem moved toward Asheville, by way of Swannanoa Gap, reaching the gap on the 20th, which was found to be blockaded and defended by about 500 men with four guns. Leaving Miller to feint in front, Gillem, with the rest of his force, on the 21st, moved to Rutherford, 40 miles south of Swannanoa Gap, and at sundown on the 22d had passed the Blue Ridge at Howard's Gap, with but slight resistance and was in the enemy's rear. At daylight of the 23d his advance entered Hendersonville, where it was learned that the Confederates had retreated through the place. Pursuit was given and 70 men and four guns captured. The entire column then moved on Asheville, and at 3 P.M., when near the town, was met by a flag of truce, with a communication from Gen. Martin, stating that he had received official notice of a truce between Gens. Sherman and J. E. Johnston, and proposing a meeting next morning. At 11 P.M. an order was received from Sherman directing the command to move to Durham Station or Hillsboro. Being convinced that Sherman had given the order in the belief that the division was at or near Salisbury, and as it would have required a march of about 200 miles to reach Durham Station, and was but 60 to his base at Greeneville, Tenn., Gillem determined to march to the latter place, and so informed Gen. Martin, when he met him next morning, of whom he requested rations to make the march, and thus relieve him of the necessity of subsisting on the country, already impoverished. Martin furnished the rations, and on the 25th Gillem set his brigades in motion for East Tennessee. The raid was one of the most successful and destructive of the war. Gillem and Stoneman report the capture of 25 guns taken in action, and 21 that the Confederates were forced to abandon in southwestern Virginia; about 6,000 prisoners, and 17 battle-flags. Consult 'Official Records,' Vol. XLIX.; Van Horne, 'History of the Army of the Cumberland,' Vol. II.

E. A. CARMAN.

Stoneman's Virginia Raid. When Gen. Hooker initiated the campaign finally resulting in the battle of Chancellorsville (q.v.), he ordered Gen. Stoneman, commanding the cavalry corps of the Army of the Potomac, about 10,000 men and four batteries, to move quietly and rapidly up the left bank of the Rappahannock, on 13 April 1863, cross the river above the Orange and Alexandria Railroad, disperse Gen. Fitzhugh Lee's cavalry brigade at Culpeper Court House, push on to Gordonsville, and from there strike the Fredericksburg and Richmond Railroad at Saxton's Junction, destroying it with all its bridges and telegraph lines, thus severing Gen. Lee's communications with Richmond. He was also directed to harass Lee's retreating troops that Hooker expected to defeat near Fredericksburg. Heavy rains delayed both Hooker's plans and Stoneman's movement, and after Stoneman had crossed one brigade at Freeman's Ford the Rappahannock rose so rapidly and high that the brigade was recalled and crossed to the left bank of the river by swimming the horses. Stoneman now waited two weeks for Hooker's initiative and better weather. On 29 April, under modified orders to cross the river between Kelly's and Rappahannock Fords, and to send one column in the direction of Raccoon Ford and Louisa Court House, Stoneman again crossed the river, with the main body, at Kelly's Ford, Gen. Averell, with three brigades and a battery, crossing at Rappahannock Station, under instructions to push on through Culpeper Court House to Gordonsville and keep the enemy employed in that direction, while detachments from the main body were destroying the railroads north from Richmond. Stoneman had in all six brigades of cavalry, numbering about 8,000 men, with two batteries. Averell was dilatory in his movement, but soon ran against a regiment of Gen. W. H. F. Lee's brigade, driving it through Culpeper Court House and beyond the Rapidan, where on the morning of 2 May he received a message from Hooker that he did not understand what he was doing at Rapidan Station, and ordering him to rejoin the army at United States Ford. Averell immediately returned, and was relieved from command because he had failed to regard the instructions given him, and had contented himself with marching but 28 miles in three days with but an insignificant force opposing him.

With picked men and horses, in light marching order, not a wagon accompanying him, Stoneman pushed forward, with three brigades of 4,300 men and a battery of six guns; Gen. Buford's regular brigade was sent to the left in detachments and, after skirmishing with small bodies of Confederate cavalry, reached the Rapidan at Raccoon Ford on the night of the 30th; Stoneman followed, the ford was crossed on the morning of 1 May, and at two o'clock on the morning of the 2d, after some opposition, and after marching through Orange Court House, Gregg's division of two brigades struck the Virginia Central Railroad about a mile from Louisa Court House and destroyed much of the railroad, and at daybreak Col. Kilpatrick, with his regiment, dashed into Louisa Court House, captured some supplies, and toward evening, being attacked by some of W. H. F. Lee's cavalry, withdrew to Thompson's Cross-Roads, and joined his division, which during the day had marched by way of Yanceyville, and concentrated at the Cross-roads after night. Here during the night Stoneman gave orders for operations upon Lee's communications by separate parties led respectively by Gen. D. Mc. M. Gregg, Col. P. Wyndham, Col. Kilpatrick, and

Digitized by Google

Lieut.-Col. Hasbrouck Davis. At midnight, with a bright moon, the various detachments started, and all were on the road before 3 A.M. of the 3d.

Wyndham, with two regiments of about 400 men, pushed southward to Columbia on James River, at its junction with the Rivanna, driving before him a squadron of cavalry, and on the morning of the 3d he destroyed some canal-boats, bridges, and a large quantity of supplies and medical stores, and attempted to destroy the stone aqueduct, by which the water of the canal was carried over the Rivanna; but hearing of the approach of W. H. F. Lee, he withdrew and rejoined Stoneman the same day, having marched 50 miles in 16 hours. He brought in 140 horses and mules, and was followed by Lee nearly to camp.

Kilpatrick marched, with one regiment, reached Hungary Station, on the Fredericksburg Railroad, at daylight of the 4th; destroyed the depot and part of the road, crossed to the Brook road, and went within two miles of Richmond, driving back a battery and some cavalry, and capturing about a dozen men within the fortifications of the city. Then he struck the railroad at Meadow bridge, over the Chickahominy, burned the bridge, ran a train of cars into the river, captured more prisoners and 60 wagons, crossed the Pamunkey and Mattapony next day, swept through the country without opposition, though closely pursued by cavalry, and reached Gloucester Point on York River on the morning of the 7th, with a loss of 38 men. He reported that he captured and paroled over 300 men.

Lieut.-Col. Davis, with one regiment, moved along the banks of the South Anna to the Fredericksburg Railroad at Ashland, scattered a few cavalry bodies, captured an ambulance train with about 250 wounded from the field of Chancellorsville, whom he paroled, destroyed the road and other property in the vicinity, and pushed on to Hanover Station on the Virginia Central Railroad, burned the depot and other property, marched to Hanover Court House, and then to within seven miles of Richmond, when he changed direction to the left and started down the Peninsula for Williamsburg. At Tunstall's Station, near White House, he met and had an engagement with Confederate cavalry, infantry, and artillery and, being repulsed in an attempt to break through, withdrew, moved to the left, crossed the Pamunkey and Mattapony, and reached Gloucester Point, after a march of over 200 miles, with a loss of 35 officers and men.

Gregg and Buford meanwhile had been raiding in the neighborhood of the South Anna, closely watched by Wade Hampton and W. H. F. Lee. Buford's brigade was broken into detachments, and on the 4th one of these, under command of Captain James E. Harrison, 5th U. S. cavalry, was attacked at Flemming's Cross-Roads, by 800 men, under command of W. H. F. Lee. Harrison had less than 100 men, and after a hand-to-hand fight of about five minutes he retreated to Yanceyville with a loss of five killed and wounded, and two officers and 31 men captured. Lee fell back to Gordonsville, hearing by telegraph from Richmond that the enemy were everywhere. The whole of Stoneman's command, excepting the forces under Kilpatrick and Davis, was concentrated on the 5th at Yanceysville, on the South Anna. Stoneman says: "The six days having now expired, during which we were assured by the commanding general he would certainly communicate with us, and no communication having been received, no retreating enemy having been seen nor heard of, and no information as to the condition of things in the vicinity of Fredericksburg, except vague rumors of our defeat and capture, having been attained; supplies for man and beast becoming scarce; having accomplished all that we were sent to perform, and having come to the conclusion that Cols. Kilpatrick and Davis, with their commands, had gone in the direction of Yorktown, I determined to make the best of our way back to the Army of the Potomac."

Knowing that the cavalry brigades of Lee and Wade Hampton were to the west of him, and that the withdrawal of Averell had exposed his flank and rear to an attack from them, he determined to send Gen. Buford, with 650 men and picked horses, to threaten Gordonsville, and another force, under Capt. Rodenbough, in the direction of Bowling Green to threaten the enemy's communications and, under cover of night, with the main body, take the middle road through Tolersville, and crossing the North Anna near the Victoria Iron Works march to Orange Springs, where all were to rendezvous next day. Everything worked favorably. Buford marched to within two miles of Gordonsville, where he found infantry and artillery in position, awaiting his arrival, upon which he turned north, marched until nearly daylight, and halted on the north side of the North Anna, near Orange Springs, where at noon of the 6th he was joined by Stoneman, who had made a night march in a heavy storm. From Orange Springs Stoneman continued his march to Raccoon Ford, on the Rapidan, thence to Kelly's Ford, on the Rappahannock, which was crossed at daylight of the 8th by swimming the horses, and then to Bealeton.

The result of the raid was the capture of over 500 men and 460 horses and mules and the destruction of nearly 20 bridges and culverts, three trains of railroad cars, 122 wagons, several canal-boats, and a large amount of army supplies. The railroads had been cut in seven places, but these breaks, which Gen. Lee considered as of small consequence, were soon repaired. As the chief object of the raid was the effectual destruction of Lee's communications with Richmond, which was not accomplished, it was considered a failure. The Union loss was 5 killed, 21 wounded, and 163 missing. About 1,000 horses were broken down and abandoned, some being killed. There are no trustworthy records of Confederate losses in killed and wounded. Consult: 'Official Records,' Vol. XXV.; the Century Company's 'Battles and Leaders of the Civil War,' Vol. III.

E. A. Carman.

Stones, Standing, or Stone Circles, are found in numbers throughout Great Britain, to a less extent in Norway and Sweden, and a few in France and northern India. The typical stone circle of Scotland, England, and Ireland consists of rough, unhewed stone set up at comparatively equal distances in the form of a circle. These circles vary in size from a diameter of 20 feet to more than 100 feet, and are composed of stones of heights ranging from less than 6

Digitized by Google

feet to 19 feet, and of varying thicknesses. The stones are set up at distances of from five feet to six yards apart and the site of the circle is usually a level plain, although the gentle slope of a hill has sometimes been used. The stones used are often in the form of huge loaf-shaped boulders set up on end and wedged in with smaller rocks at their bases; sometimes the standing stones are set into a slight excavation in the soil. In a number of the stone circles found in Scotland the space between two of the upright pillars, usually the two at the southwest side of the circle, is filled by a large flat rock set up on edge and extending from pillar to pillar. The location of this distinguishing feature at the southwest seems coincident with the general plan of structure and location of the supposed altar stone in the structure of Stonehenge (q.v.). Some of the stone circles contain a second smaller circle within them, which circle is often composed of stones larger than those in the outside circle; and some of the examples show a ditch around the circle of pillar stones, or else an earth wall. In either case whether it is ditch or wall, the entrance over or through it is invariably to the northeast. The ditches are in some instances as wide as 30 feet with a depth of six feet; the walls rarely exceed five or six feet in height, and the entrances over the ditches are usually half as wide as the ditch proper. In one notable instance, that of a small circle of large stones near the Great Circle of Stennis, in Orkney, Scotland, both the ditch and the rampart occur, the latter within the former, and the entire interior area of the circle is raised about three feet higher than the surrounding level.

Besides the circles of standing stones and great boulders, there are also found in the same territory and in Algeria, Syria, and northern Arabia, continuous circles of smaller stones bedded in the ground or resting on the surface. Explorations of the interior area of these circles has established the fact that they were used for burying grounds, and from the nature of the contents, the burial urns, and the implements found beside the graves, Sir John Lubbock has concluded that they belong to the Bronze Age. (See STONEHENGE.) But it is to the circles of standing stones that the chief interest attaches and while it has never been proven that these areas were intended for burying grounds there seems to be sufficient reason for belief that they were connected with the burial rites of the people who erected them. This theory is borne out by the presence of burial mounds or barrows (known as cairns in Scotland and Ireland) in close proximity to all the larger circles. Indeed in some cases the cairns were surrounded by the circle of stones; as is seen in the great chambered cairn of New Grange in Ireland, and in the smaller ones of Clava, near Inverness. Although it is more often the case, the contents of the cairns, particularly of the larger ones, do not always show interments of the Bronze Age. In this latter case there is no incinerary urn containing the deposits or over them, and the remains show that there has been no cremation. In like manner many of the stone circles, indeed the great majority of them, show no evidence of tool-work in their building, while the imposts of the outer circle and outer ellipse of Stonehenge give conclusive proof of it.

As a rule the cairns which covered the cremation interments of the Bronze Age are smaller than those of the preceding period, and the custom of placing the burnt bones in a cavity in the soil, covered only by an inverted urn of clay, dispensed with the cairn altogether, while it retained the circle of standing stones as a visible mark or fence of the grave ground. In about 20 instances in which there has been systematic excavation of stone circles in Scotland the examination of the interior space has disclosed burials of the Bronze Age mostly after cremation but occasionally unburnt. The cremated remains were deposited with cinerary urns placed either in an inverted position over the burnt bones or upright and containing the burnt bones, at the bottom of a shallow pit excavated in the subsoil. These cinerary urns exhibit the forms and ornamentation characteristic of the age of bronze. Sometimes the burials have been placed in cists of unhewn slabs of stone, covered by small cairns of loose stones, underneath the surface level; at other times the burnt bones of many burials have been found placed in shallow cavities excavated in the soil of the interior area of the circle near the bases of the upright stones. It seems from these circumstances that the common variety of stone circles, as found in Scotland, are cemeteries of the Bronze Age, and while, on the one hand, the difference in the size of the circles of Avebury and Stennis and in the structure and size of Stonehenge, may point to a difference in purpose and use, on the other hand, the great size of the circle surrounding the chambered cairn at New Grange and the objects uncovered by the repair excavations at Stonehenge in 1901, seem to show that a great circle also was associated with a sepulchre.

The largest of the Scotch stone circles is that of Stennis, in Orkney. It has a circumference of 340 feet, enclosing an area of 2½ acres, and is surrounded by a ditch 30 feet wide. It originally consisted of about 60 pillars, set about 17 feet apart, of an average height of about 13 feet. Of these 13 still stand and 10, though prostrate, are intact. The largest stone circle in England is that of Avebury, in Wiltshire, which consisted of a large outer circle of probably 1,000 stones of from 15 to 17 feet in height and 40 feet in circumference; this circle was about 1,000 feet in diameter and contained two smaller circles of 350 and 325 feet in diameter respectively. The inner circles each consisted of a double row of stones, a stone pillar 20 feet high occupied the centre of one, and a bowing-stone, or cromlech, that of the other. Surrounding the whole were a broad ditch and a high earth-wall, traversed by an avenue of approach which led toward the southeast for over 1,400 yards. This structure and Stonehenge are considered the most remarkable examples found in England of monuments of megalithic stones (q.v.). In Norway and Sweden the few stone circles systematically explored have been found to be burial places of the Iron Age. They are usually simple circles composed of 8 to 13 stones; occasionally there are two concentric circles, one within the other, the inner circle being sometimes composed of small stones set close together in a ring. Sometimes there is a single pillar stone in the centre of the circle. As a rule they are not remarkable either for the size

Digitized by Google

of the circles themselves or for the massiveness of the stones of which they are composed. Circles of standing stones are rare to the south of the Baltic. See bibliography under STONEHENGE. Consult also Dawkins, 'Early Man in Britain' (1880).

Stoneware is that kind of earthen ware (see CERAMICS) which is impervious to water and non-absorbent, almost non-porous, the whole substance of the paste being very silicious, either from the original nature of the clay or from a mixture with the clay of some natural silex such as flint. A simple test is that a broken fragment, if put to the tongue, will not seem to cling to its surface; whereas a broken flower-pot will cling tenaciously, this being caused by the rapid absorption of moisture by the porous substance. It is for this reason that stoneware is used for ink bottles, vinegar jugs, and all such common purposes, and also for larger and more decorative vessels in countries and in times where it is customary to use earthenware vessels instead of glass or metal at least to a great extent. Thus in the Rhine towns and northwestern Germany during the 14th and following centuries a very elaborate series of cans, jugs, and flagons of all sizes from a pint to three or four gallons, were made and decorated by simple impressions from metal or wooden dies impressed upon the surface before firing; the pattern being afterward more or less emphasized by a thin glazing of blue applied in parts. The glaze of stoneware in the usual sense is no more a separate substance than that of Greek vases; it is a mere modifying of the surface generally by some vaporized ingredient which is absorbed during the actual process of firing. Thus the most common glaze, called salt-glaze, is generally understood to be produced by throwing into the furnace rough salt, which is vaporized and leaves the soda in its composition on the surface of the stoneware in the form of a slight, glassy film. The stoneware would not need this to be sufficiently resistant against water, wine or the like, but some acids would attack the stoneware, against which the glaze is a sufficient protection.

These decorative wares have been known to the collectors, and in museums and in treatises on Ceramics under the general name of grés de Flandre, as if they were of Flemish make, but this term is now replaced by such terms Cologne Ware, German Stoneware, and the like. In modern times stoneware has not been generally used for decorative purposes; but recent experiments in the national manufactory of porcelain at Sèvres in France have led to the invention or adoption of many brilliant colored enamels which can be applied to stoneware without in the least diminishing its value as a durable and weatherproof material; and in this way a whole class of architectural ceramic wares has been made practicable. Magnificent specimens of these wares — even to the extent of huge friezes containing many figures, were on exhibition at Paris in 1900; and any future attempts at decorative architecture will have to include the consideration of these new means of brilliant adornment in color and in form.

RUSSELL STURGIS.

Stonington, stō'nĭng-tŏn, Conn., town, port of entry, New London County; on Long Island Sound, and on the New York, New Haven & Hartford Railroad; about 10 miles east of New London and 40 miles southwest of Providence, R. I. It comprises the borough of Stonington and the villages of Mystic, Old Mystic, and Pawcatuck. There is a good harbor and regular steamer connection with Boston and New York. The chief manufacturing establishments are cotton and woolen mills, iron and brass works, boiler works, printing presses, spool factories, machine shops manufacturing silk and cotton machinery. The products of other manufacturing establishments are silk and cotton thread, velvet, paper cutters, and novelties. The government census of 1900 gives the number of manufacturing establishments, 118; the amount of capital invested, $3,733,679; the number of wage earners, 1,967; the annual wages, $902,740; the annual amount paid for material, $344,536; and the value of the products, $3,231,423. The educational institutions are an English and classical institute, a high school, public elementary schools, private schools, and a public library. The national bank has a capital of $200,000. Pop. (1890) 7,184; (1900) 8,540; (1910) 9,154.

Stony Point, N. Y., town in Rockland County, on the west bank of the Hudson, and on the New Jersey & N. Y., the New York, O. & W., and the West Shore R.R.'s; 40 miles north of New York city. At this point is the rocky promontory from which the town derives its name, which was strongly fortified during the Revolutionary War by the British. In 1779 the Americans had begun to fortify the place, but were forced to abandon it by the British under Clinton, who then completed the fortifications. The only land approach was across a marsh which was covered by water at high tide, and was defended by a double line of abatis and picket stations. Washington had determined on a recapture of Stony Point, and for this purpose organized a body of picked troops known as the Corps of Light Infantry and placed Gen. Anthony Wayne (popularly called «Mad Anthony») in command. Wayne carefully reconnoitered the place and decided for a night attack and surprise, which was carefully planned by Washington. In accordance with this plan, Wayne brought his men as near Stony Point as possible, and by 8 P.M., 15 July, camped about a mile from the fort. Here he divided his force into columns, and about 11:30 commenced the march against the fort; when the marsh was reached, one column under Wayne turned to the south to cross the marsh, the other to the north. By the time the Americans had crossed the morass, the British were thoroughly aroused, and opened fire upon both columns. The Americans did not fire but charged with the bayonet so impetuously that the enemy were quickly driven from the outer and inner abatis into the fort, where they were obliged to surrender; the two American columns reached the fort almost at the same time. Wayne was wounded in the head during the charge, and was carried into the fort, but the wound proved slight. The whole British garrison of over 540 were taken prisoners; the Americans lost only 15 killed, the British 63. The Americans were not able to hold the place, but destroyed the fortifications, and it was reoccupied for a time by the British who, however, abandoned it in October. The immediate effect of the victory was to encourage

Digitized by Google

the Continental army, and increase the confidence and zeal of the people. The site of the fortifications was acquired as a public park by New York State in 1897. Pop. of the town (1910) 4,000.

Sto'nyhurst College, England, a Roman Catholic institution 10 miles north of Blackburn, Lancashire. The college was originally founded at St. Omer in Flanders in 1592, but in 1794 was transferred to England. It is affiliated to the University of London, and provides a school course of instruction for boys and a university course for young men. Attached to it is a good observatory, an excellent library, museums, etc. Several well-known men have been educated here. The series of 'Stonyhurst Philosophical Manuals' by the Jesuit professors in the philosophical department of the college represents an able and notable attempt to revive the scholastic philosophy as expounded by St. Thomas, and adapt it to modern thought.

Stoop, in architecture, an uncovered platform at the entrance to a house or other building, raised to the height of the door-sill and approached by a flight of steps, the same width as the stoop. The word is Dutch, having its origin in New York in Colonial days. It is frequently used incorrectly for porch or veranda.

Stoppage in Transitu, in law, is the exercise of a right allowed by law to a seller to stop the delivery of goods purchased by a buyer who has become bankrupt while the goods are in the hands of a carrier or middleman for transmission. Under the laws of England it is not necessary that the vendee should have been judicially declared bankrupt or insolvent; mere inability to pay his debts as they become due constitutes the insolvency contemplated by the law. Of course the burden of proof rests on the seller to establish the fact of insolvency or bankruptcy in case it is denied. Stoppage in transitu is not held to cancel the transaction, but only to place the goods under lien of the seller for the price. The transitus, during which goods are liable to stoppage, is terminated by actual or constructive delivery to the buyer or his agent. A common carrier is not considered the agent of the buyer, although employed by him for the transmission of the goods; but if goods are delivered at a shipping port to a buyer's agent for transshipment, the transitus is at an end and cannot be renewed when they are redelivered to a common carrier. Although the buyer is the charterer for the voyage of the ship in which the goods are carried they are not held to be delivered to him until the delivery is completed in the usual manner at the close of the voyage; but if he has hired the ship for a period it will be considered as his premises and the delivery will be complete. The law of the United States in relation to this subject is virtually the same as that of England.

Storage Batteries. See ELECTRIC STORAGE BATTERIES.

Store Checks. See TRUCK SYSTEM.

Sto'rer, Bellamy, American diplomat: b. Cincinnati, 28 Aug. 1847. He was graduated from Harvard in 1867, and from Cincinnati Law School in 1869. He practised law in Cincinnati; was a member of Congress, 1891–95; United States Minister to Belgium, 1897–99, and to Spain, 1899–1902. From 1902–6 he was United States Ambassador to Austria-Hungary.

Sto'rey, George Adolphus, English painter: b. London 7 Jan. 1834. He first exhibited at the Royal Academy in 1852. In 1863 he was in Spain, painting portraits at Madrid. Among his pictures are: 'A Royal Challenge' (1865); 'After You' (1867); 'The Shy Pupil' (1868); 'The Old Soldier' (1869); 'The Duet,' and 'Only a Rabbit' (1870); 'Rosy Cheeks,' and 'Lessons' (1871); 'Little Butter-Cups' (1872); 'Caught' (1875); 'A Dancing Lesson' (1876); 'The Ivory Door' (1881); 'Coracles on the Dee' (1882); 'The Connoisseur' (1883); 'First Practice' (1894); 'Rival Minstrels' and 'Coming Events' (1895); 'A Love Stratagem' (1896); 'A Fair Musician' (1897); 'Daughter of the Regiment' (1897); 'In Evening Shade' (1898); besides numerous portraits.

Storey, Moorfield, American lawyer: b. Roxbury, Mass., 19 March 1845. He was graduated from Harvard University in 1866, and from the Harvard Law School three years later. He was private secretary to Charles Sumner 1867–69, and from 1873–79 was editor of the 'American Law Review.' He has published 'Life of Charles Sumner' (1900).

Storks, a family (*Ciconiidæ*) of wading-birds of the order *Herodiones*. In this family the bill is very stout at the base, longer than the head, usually straight but occasionally curved either up or down. The nostrils are remarkable in being entirely unprotected either by a scale or bristles; they are placed close to the base of the bill and perforate its horny sheath directly, not being even sunk in a groove. The hallux is placed on a level with the other toes which are either moderately or considerably elongated and terminate in a more or less flat, broad claw. The general aspect of these birds is somewhat heron-like but they lack all of the grace of those birds, being of rather heavy build and clumsy action. To this family belong the true storks, the jabirus and the wood ibises, the latter being quite distinct from the true ibises. True storks form the subfamily *Ciconinæ* and, with the exception of the closely related American jabirus, are confined to the warmer parts of the Old World, where about six genera occur. The white stork (*Ciconia alba*), which during some portion of the year is found in most parts of Europe, Asia and Africa, is the celebrated bird of German and Dutch story and folklore; and familiar from the pictures in children's Christmas books of German manufacture. In its domesticity and love of human habitations as nesting-sites it departs widely from the solitary, retiring habit of most of its kindred; but in other respects it is thoroughly a stork, feeding upon frogs, small fishes, mice and insects, which are captured in the marshes and meadows; sleeping during the heat of the day often with one foot drawn up and the bill lying on the breast; becoming active at dusk and in the cool of the morning; voiceless but producing a clattering noise with its bill; during the mating season indulging in dances and other queer stiff-legged antics; and on the approach of cold weather spreading its wings for Africa, even to its uttermost southern end. They fly in pairs or small flocks at a great height and with their long legs stretched out straight behind. A stork's nest on the house-top is the best of good omens and as

Digitized by Google

the birds are undisturbed they return year after year to add to the huge structure of sticks and raise another callow brood. Other species of the same genus inhabit Europe, Asia and Africa but they breed on rocky cliffs or tall trees and shun human habitations. The adjutant (q.v.) (*Leptoptilus dubius*) of India is another semi-domesticated species which acts as a scavenger and feeds largely upon carrion. A very peculiar Indian stork is the open-bill (q.v.) in which the mandibles do not completely close. Its food consists largely of mussels. But two species (*Dissura maguari* and *Mycteria americana*) inhabit America, the last only, the jabiru, entering occasionally the southernmost United States. It is a large bird, standing more than four feet high, with a huge, massive bill more than a foot long, the head and neck bare and black except for a bright red zone on the lower part of the latter; the plumage is entirely white. The young are largely grayish. Along the seacoast and about the mouths of some of the rivers of tropical South America this bird is very abundant. Besides capturing living reptiles, frogs, etc., it feeds upon carrion and has a curious habit of probing the mud with its bill in search of worms and larvæ. Its nest, a platform of sticks, is built in tall trees and two dull green eggs more than 3 inches long are laid. When angered or excited the crop is inflated beneath the red skin of the throat which swells out like a huge ball of a most threatening aspect. The wood ibises form the subfamily *Tantalinæ*, distinguished from the true storks chiefly by the strongly decurved bill and longer claws. *Tantalus* is generally considered to be the only genus, with species in tropical Africa, India and the Malayan Islands, and the American *T. loculator* which inhabits the entire South American continent and the southern United States, occasionally straying northward to Pennsylvania and New York. Except that it is gregarious, especially when breeding, its habits are stork-like. In the Southern States the wood ibis is resident in thickly wooded swamps along the seashore, rivers and bayous where it is extremely abundant in many places. In Florida, however, it is said to be more solitary. When feeding it rakes the bottom with its hooked bill and captures the small fishes, worms, mollusks and crustaceans thus disturbed; in fresh waters it captures especially crayfishes and batrachians, and on land snakes, lizards, and rats. The 2 or 3 eggs are dull white. Consult 'Newton Dictionary of Birds,' (London, 1896); Gubernates, 'Zoological Mythology' (New York 1872); Baird, Brewer and Ridgway, 'North American Water Birds,' Vol. I., (Boston 1884).

Storm, Theodor, German poet and novelist: b. Husum, Schleswig, 14 Sept. 1817; d. Hademarschen, Holstein, 4 July 1888. He studied law at Kiel and Berlin, becoming intimate at Kiel with Theodor and Tycho Mommsen. He then commenced the practice of law at Husum; was driven from there in 1853 on account of his German sympathies, and went to Prussia where he held judicial offices at Potsdam and Heiligenstadt. In 1864 he returned to Husum, where he was appointed judge in 1874 and in 1880 he retired from public life. His first literary work included several lyric poems published with Theodor and Tycho Mommsen under the title 'Liederbuch dreier Freunde' (1834); other poetical works are 'Sommergeschichten und Lieder' (1851) and 'Gedichte' (1852). His greatest success, however, was attained through his short stories and novels; his most popular and one of his earliest stories is 'Immensee' (1852), which is eminently characteristic of his genius as a writer, and holds a high rank in literature. His other works include: 'Im Sonnenschein' (1854); 'Angelica' (1855); 'Im Schloss' (1861); 'Von jenseits des Meeres' (1864); 'Die Regentrude' (1864); 'Der Spiegel des Cyprianus' (1865), a historical story; 'Pole Poppenspäler (1874), a children's story; 'Ein stiller Musikant' (1874); 'Psyche' (1875); 'Aquis Submersus' (1876); 'Carsten Curator' (1878); 'Ein Bekenntniss' (1888); and 'Der Schimmelreiter' (1888). His correspondence with the poet Mörike was published by Jacob Bächtold in 1891. Consult: Schultze, 'Theodor Storm, sein Leben und seine Dichtung' (1887); Wehl, 'Theodor Storm' (1888); Stern, 'Studien zur Geschichte der Deutschen Litteratur' (1895).

Storm is a general name applied to any violent commotion or disturbance of the atmosphere, producing or attended by wind, rain, snow, hail, or thunder and lightning; a tempest; often applied to a heavy fall of rain, snow, etc., without a high wind. See ATMOSPHERE; LIGHTNING; METEOROLOGY; WIND.

Storm and Weather Signals. See METEOROLOGY; WEATHER BUREAU.

Storm King, or Butter Hill (called by the early Dutch *The Klinkenberg*, which means «Echo Mount»), one of the highest peaks of the Highlands, on the west bank of the Hudson, in the town of Cornwall in Orange County, N. Y. It is a rounded mass, made more conspicuous by being on the river's bank. The village of Cornwall is near by. The peak stands like a «storm king» at the northern «Gate of the Highlands,» as a protection against the fierce storms of the north.

Storm-petrel. See MOTHER CAREY'S CHICKEN.

Stornoway, stôr'nō-wā, Scotland, a seaport in Ross and Cromarty County, on the east coast of the island of Lewis. The principal buildings are the court-house, assembly-rooms, public library, customs house, drill-hall, industrial and grammar schools. There is a naval reserve station, a good harbor with quays and wharves, and a ship-building yard with patent slip. The herring and whitefish fisheries are valuable.

Storrs, stôrz, **Richard Salter,** American Congregational clergyman: b. Braintree, Mass., 21 Aug. 1821; d. 5 June 1900. He was descended from a long line of ministers; was graduated at Amherst in 1839, and at the Andover Theological Seminary in 1845; preached for a year in Brookline, Mass.; and in 1846 became minister of the Church of the Pilgrims, Brooklyn, N. Y., continuing in that pastorate until his death. He reached a commanding position among the leading preachers of his time, and added new meaning and dignity to the title of pulpit orator, which by eminence he bore, although his oratory was free from limitations of a professional character, being effective through its intellectual and moral qualities and its masterful delivery, whatever the subject or the occasion might be. He was also a scholar and writer of much distinc-

Digitized by Google

tion, and contributed articles on various subjects to many publications. From 1848 to 1861 he was one of the editors of the 'Independent.' He also published 'The Graham Lectures on the Wisdom, Power, and Goodness of God, as Manifested in the Constitution of the Human Soul' (1856); 'The Conditions of Success in Preaching Without Notes' (1875); 'The Divine Origin of Christianity Indicated by its Historical Effects' (1884); 'Bernard of Clairvaux' (1892); 'Forty Years of Pastoral Life'; and also many religious, historical, and literary discourses of varied interest, some of which possess a recognized permanent value. From 1887 to 1897 he was president of the American Board of Commissioners for Foreign Missions.

Storthing, stŏr'tĭng, the parliament or legislative assembly of Norway. It is elected triennially, and holds annual sessions. See NORWAY.

Sto'ry, Joseph, American jurist: b. Marblehead, Mass., 18 Sept. 1779; d. Cambridge, Mass., 10 Sept. 1845. He was graduated from Harvard in 1798, and afterward studied law. In 1808 he entered Congress, in 1811 became speaker of the Massachusetts State legislature, and soon after was appointed a judge of the United States Supreme Court. In 1829 he became first Dane professor of law at Harvard, a position which he held for the rest of his life. His law works include special treatises, commentaries, and judgments, and a collection of his miscellaneous writings was published in 1852. Among the legal works are: 'On the Law of Bailments' (1832); 'On the Constitution of the United States' (1833); 'On Equity Jurisprudence, as Administered in England and America' (1836); 'On the Law of Agency' (1839); 'On the Law of Partnership' (1841); 'On the Law of Bills of Exchange' (1843); and others. In his constitutional opinions he was of the school of Washington and Chief-Justice Marshall, advocating just powers for the Union without encroachment upon the rights of the respective States. His judgments in the Supreme Court may be found in the reports (1811–45) of Wheaton, Cranch, Howard, and Peters. Consult, 'Life and Letters' (1851) by his son William Wetmore Story (q.v.).

Story, Julian, American artist: son of W. W. Story (q.v.): b. Oxford, England. He was educated at Eton and Oxford, studied art at Paris and in 1889 received the third class medal at the Paris Salon; in 1891 he took the gold medal at the Berlin Exhibit and in 1900 was awarded the silver at the Paris Exposition.

Story, William Wetmore, American sculptor and author: b. Salem, Mass., 19 Feb. 1819; d. Vallombrosa, near Florence, Italy, 7 Oct. 1895. He was graduated from Harvard in 1838, from its law department in 1840, was admitted to the bar at Boston, and published treatises 'On the Law of Contracts' (1844) and 'On the Law of Sales of Personal Property' (1847), besides three volumes of 'Reports of Cases Argued and Determined in the Circuit Court of the United States for the 1st Circuit' (1847). Two volumes of 'Poems' appeared in 1847 and 1856. In 1848 Story went to Rome, where he afterward chiefly resided as a sculptor and writer. He was United States commissioner on fine arts to the Paris World's Fair of 1879. Among the better known examples of his art are busts of Lowell, Josiah Quincy, and Theodore Parker; a statue of Everett in the Boston Public Gardens; a statue of George Peabody for London (1869), placed in replica in Baltimore in 1888; 'Saul'; 'Jerusalem'; 'Semiramis.' Of his further books may be mentioned 'Roba di Roma' (1862); 'Graffiti d'Italia' (1869); 'The Tragedy of Nero' (1875); and 'Fiammetta' (1885). Consult the 'Life' (1903) by Henry James.

Story, or Storey, in architecture, a floor of a house or other building, or a set of rooms on the same level or floor. A story is considered the distance from floor to floor, usually 9, 12 or 16 feet apart.

Stothard, stŏth'ard, **Thomas,** English painter: b. 17 Aug. 1755; d. 27 April 1834. He very early exhibited a taste for drawing. At 8 he was placed at school at Stretton, near Tadcaster, where he remained till his 13th year, when he was removed to a boarding-school at Ilford, Essex. On his father's death, about a year after, he was bound apprentice to a drawer of patterns for brocaded silks in London. His apprenticeship was cut short in consequence of the decline of the trade. In 1777 he became a student at the Royal Academy, and in the following year exhibited as his first picture there 'The Holy Family.' In 1791 he was elected an associate of the Academy, and in 1794 he became an academician. Among his works may be mentioned his designs for novels by Richardson, Fielding, and Smollett; for Sterne's 'Tristram Shandy'; for Milton's works; for Rogers' Poems and 'Italy'; some historical pictures, and his Canterbury Pilgrims. He painted internal decorations of buildings, and designed silver plate, medals, etc. He is said to have made 5,000 designs, 3,000 of which were engraved. Consult, 'Life' by Mrs. Bray (1851).

Stoughton, stō'tŏn, **Israel,** American colonist: b. England at the close of the 16th century; d. Lincoln, England, 1644. He emigrated to America in 1630 with the company which founded Dorchester, Mass., of which John Endicott was a conspicuous figure, and served the colony as assistant to the governor during a number of years. He was identified with the famous antinomian controversy introduced by Ann Hutchinson and Wheelwright, and having written a pamphlet upon the subject which was displeasing to his fellow townsmen, was removed, but was later restored to his place in the government of the community. In 1639 he was appointed to act with Endicott in a boundary dispute with the Plymouth colony, but in 1644 he left Massachusetts and returned to England.

Stoughton, William, American colonist, son of Israel Stoughton: b. about 1630; d. Dorchester, Mass., 7 July 1701. He studied at Harvard and was afterward graduated at Oxford. Returning to America, he was elected assistant in the Dorchester colony from 1671 to 1686. In 1692 he was appointed lieutenant-governor of Massachusetts, and in this capacity presided over the witchcraft trials at Salem.

Stoughton, Mass., town in Norfolk County; on the New York, New Haven & Hartford Railroad; 16 miles south of Boston. Within its limits are the villages of Stoughton, West Stoughton, and North Stoughton. The chief manufacturing establishments are woolen mills, rubber works, boot and shoe factories, and

Digitized by Google

machine shops. The town has one public high school, 17 district schools, several private schools, and a public library, established in 1874. There are several beautiful residential sections and, in the southern part of the town, are some small bodies of water. Pop. (1890) 4,852; (1900) 5,442; (1910) 6,316.

Stout, George Frederick, English psychologist: b. South Shields 6 June 1859. He was educated at St. John's College, Cambridge, of which he has been a fellow since 1884. He was Anderson lecturer in comparative psychology at the University of Aberdeen in 1896, and has been editor of 'Mind' from 1891. He has published 'Analytic Psychology' (1896); 'Manual of Psychology' (1899); etc.

Stoves and Heating Apparatus.— Any system of heating must necessarily include three things, the combustion of fuel in a fire-place, stove, furnace, steam or hot-water boiler; a system by which the heat is transmitted to its destination with the least possible loss; and a system of diffusion, by which the heat is conveyed to the air in a room, and to its walls, floors, ceilings, etc. The oldest, simplest and most economical method of heating is by the stove, which requires no system of transmission, but by radiation and convection diffuses the heat directly to the air and to the objects in the room. Though this method has not been entirely superseded by the hot-air furnace, owing to the cost of installing the latter, the furnace has largely done away with use of the stove solely as an apparatus for heating purposes, beside which the furnace has many advantages over the stove, as such. The hot-air furnace is generally constructed of brick, or cast or wrought-iron plates welded together, and provided with a brick-lined fire-pot; there is a combustion chamber over the fire; and between these latter two and the outside casing is left a space for the circulation of air. Through a box or pipe, called the «cold-air box,» located at the bottom of the casing, fresh air is brought from outside, enters the space between the casing and the fire-box, passes over the heated surface of the fire-pot and combustion chamber, and, by means of pipes at the top of the casing which connect with the registers, is transmitted to the various rooms of the house.

The furnace in its turn was followed by the steam boiler which transmits the steam to radiators throughout the house, and form them the heat is diffused to the air in the room. This method of heating has come into use largely as the office building has been increased in size, and the majority of such buildings are now heated by steam. Gas and oil stoves have also become valuable as means of heating isolated rooms in a building or house, not otherwise connected with any heating appliances.

Stoves.—In searching the records to ascertain when the first stove was cast, we learn that in 1490 the first stove was reported as being made in Alsace, and that in 1509 others were cast in Islenberg. The first blast furnace erected in this country at Lynn, Mass., in 1642, turned out a small round-bottomed kettle with a cover, probably the first stove of any description made in this country. The industry lagged for nearly a century, and it was not till the middle of the 18th century that the manufacture was pushed to any great extent. About 1735 Christopher Sower, of Germantown, Pa., began to manufacture the jamb-stove, which was the first attempt to heat other rooms than the one in which the great brick fire-place was located. This jamb-stove consisted of a cast-iron box built into the side of the kitchen fire-place, one end opening in the adjoining room, the other being heated by the fire, so that when the door of the jamb-stove was opened, a small amount of heat was transmitted to the room.

In 1744 the manufacture of Franklin stoves was commenced in Philadelphia. This stove, the invention of Benjamin Franklin, consisted of a cast-iron open fire-place, jutting out from the chimney, and thus the heat was thrown out from three sides into the room, instead of only the one side, as in the jamb-stove. Between 1752 and 1760 the six-plate, or box-stove, which was the pioneer of the many modern forms of heating apparatus, was made in Marlboro, Va. Stoves were made in 1760 by Baron Steigel, of Letitz, Pa., and in 1786 box-stoves were made in Philadelphia, but were not put together there, that work being done at Providence, R. I., and Troy, N. Y., whither the plates were shipped. In 1802 Isaac Orr began the manufacture of the cylindrical or oval stoves of sheet-iron, at Philadelphia, and in New Hampshire. This was the forerunner of the oval-regulator, having a fire-damper, automatically opened and closed by the difference in expansion of a brass rod and the sheet-iron stove-body. In 1820 the Conant stove was made at Brandon, Vt., and the Woolson stove soon followed, being first made at Brandon, Vt., and put together at Claremont, N. H., but they were later manufactured in Massachusetts, Cleveland, and Detroit. In 1836 a stove having an illuminated case of cast-iron and mica, enclosed flues, a check-flue, and a direct draft-damper, was made by James Atwater, of New York, and almost simultaneously the Stanley square heating-stove was brought out. The cylinder-stove, invented by Dr. Bushnell in 1845, except for the fact that it was cylindrical and the inside was lined with fire-clay, was similar to the Stanley stove, the latter having return and exit flues enclosed in the four corners, whereas the former had a pipe at the back through which the heat made its exit after having come down the four pipes or flues in the corner to the hollow base. The next in succession was the round or oval gas burner or surface-burner, made of sheet-iron, and having the flues which returned the heat to the base enclosed in the body of the stove. In these gas-burners also the coal was more thoroughly burned out by having perforated fire-pots and perforated gas-rings at the top of the brick. Fuller, Warren & Company, of Troy, N. Y., made the style of oval and round parlor stoves most generally used, the P. B. Stewart.

The base-burner has been in use for many years, one of the first to be constructed being the self-feeder, patented by Jordan L. Mott, Sr., of New York, in 1833, the plan of his

Digitized by Google

stove being to feed the coal from a magazine to the fire-box, and to use the chestnut size of anthracite coal. This was followed in 1852 by the self-feeding base-burning stove, and in 1862 by the "Morning Glory," both of which were the inventions of D. G. Littlefield, of Albany, N. Y.; then came the "American" of Van Wormer & McGarvey, of Albany, and in 1863 the revertible-flue gas-burner with the magazine attachment, the production of Hailes & Treadwell, in Albany. Since then there have been innumerable styles of stoves introduced, with many more or less valuable changes and additions. The following are the most important of these: the base-burner having a small mica window opposite the grate, by Hunt and Miller, of Hudson (1865); the anti-clinker direct draft base-burner, by James Spear, of Philadelphia (1871); "Keep's Side-Burner," having a full mica section below and above the fire-pot, by W. J. Keep (1871); the "Argand" base-burner, a combination of the "American" with an anti-clinker grate and the full double illumination, by Perry & Company, of Albany (1873); the "Splendid" by Fuller, Warren & Company (1875); the "Garland" by the Michigan Stove Company (1876); Keep's square-base and square-sided, round front and round fire-pot, called the "Art Garland," by the Michigan Stove Company (1884); the "Hub" base-burner, by Smith & Anthony, of Boston (1884); the Keep "Reflector Art Garland," by the Michigan Stove Company (1887); and many other makes, including the oval sheet-iron stove, known as the "Tamale," and the P. D. Beckwith "Oak" stove, having fluted fire-pot, steel drum and air-tight fittings.

In the cooking stove there has been as much change as in the stove used for purely heating purposes. The pioneer in this line was the James stove, a nine plate, with the oven on the side of the stove. The next in succession was the Conant stove, invented in 1819, which had the oven directly over the fire-pot and doors at both ends, but as the fire underneath the oven heated the bottom too quickly, this style was soon abandoned. The Woolson stove, of Claremont, N. H., having the oven at the side, the heat being thrown under or over it by means of dampers, was next on the market, but as the fire caused the oven to bake more rapidly on the near side, the oven was next placed at the rear and above the boiler-holes. In 1833, Stanley invented the rotary cook stove, with the cooking holes and fire-box on the same level as the oven. The next step along progressive lines came in 1810-20, in shape of an oval stove, the invention of a Mr. Hoxie, of Salisbury, Conn., in which the fire, having gone down the two end flues and met at the bottom, passed to the chimney through an aperture in the hearth of the fireplace over which the stove was situated. P. P. Stewart patented two stoves, one in 1828, the other in 1850, in the first of which the fire-box was hung in the upper part of the oven, thus throwing off heat from three sides while the flame passed all around the oven on the outside and out the pipe collar on top of the stove. The latter, the large oven stove, had a sheet flue underneath with three flues at the rear. At about the same time, 1850, the curved plate, which dumped the ashes from the grate into the pit in the hearth, was invented by Samuel Pierce, and since then only minor changes have been made in construction, the water-tanks, reservoirs, grates, etc., being re-arranged, various methods of open ventilation, return-flue construction and different styles of ornamentation being introduced.

There have been few changes in ranges made, the main difference being that there is only one door, the pipe being on the side where the other door was formerly placed; tin has been replaced by aluminum in the lining of oven doors; and many varieties and styles of ornamentation have been made for selling purposes.

A sheet-iron range, in which the grate containing the fire was suspended inside a sheet-iron casing, the heat thus coming from the fire direct, was placed on the market in Boston, in 1850, by a Frenchman named Gillette. About the same time a similar range was made in New York by Duparquet, Huot & Moneuse, but they later made a radical change in the construction by placing flues around the oven, as at present, and the oven was made a separate part of the construction. These two were followed, in 1885, by the wrought-iron range of John Van, of Cincinnati, but with the many rapid advances made in the manufacture of steel, the use of wrought-iron has largely given place to the use of blue polished steel and aluminum painted steel.

The manufacture of stoves is largely carried on in the West, at the present time Detroit being the centre of trade. The earliest factories in the East where stoves were made exclusively were at Troy, Albany and New York. The West then began to loom up, the first foundry being established in Detroit about 1830, known as the Hydraulic Iron Works, which was followed by Dwyer & Brother, in 1861. This firm later became the Detroit Stove Works, which, in 1871, was followed by the Michigan Stove Company, and in 1881 by the Peninsula Stove Company and others. The competition thus engendered between western and eastern manufacturers soon led to the establishment of branch foundries by the eastern people in western cities, and Chicago became the centre of distribution. The statistics of the trade are meagre, but for the year 1900, the output of stoves was valued at $35,446,600, distributed through the States as follows: Pennsylvania, $5,209,000; Michigan, $4,935,000; New York, $4,913,700; Ohio, $4,384,200; Illinois, $3,801,000; Massachusetts, $2,061,800; Missouri, $1,921,000; Indiana, $1,439,500; Tennessee, $1,280,000; Kentucky, $1,044,000; Wisconsin, $972,000; Maryland, $550,500; Virginia, $402,000; Connecticut, $392,400; New Jersey, $322,000; Kansas, $306,000; Oregon, $269,000; Maine, $268,600; Rhode Island, $250,000; Alabama, $229,400; Georgia, $196,000; Minnesota, $185,000; Colorado, $50,000; California, $36,000; and New Hampshire, $28,500.

The manufacture of gas stoves has also come to be of some importance, the gas

Digitized by Google

stove being more easily handled and cleaned than the general run of cooking stoves. In 1900 there were 35 establishments manufacturing gas and oil stoves, capitalized at $3,766,065; having 191 salaried clerks and officials whose salaries were $231,436; wage-earners, 2,471; wages, $1,138,442; miscellaneous expenses, $274,242; cost of materials used, $2,501,568, and having products valued at $4,579,700.

Furnaces.—The first hot-air furnace for supplying pure heated air to rooms was probably that constructed by Franklin in 1744. This was a sheet-iron oblong box, burning wood, the smoke passing into the chimney over the top of the flat chamber behind the fire, and between it and the real back of the stove. The cool air entered this flat hollow chamber through a pipe, and when heated passed through small holes in the side of the chamber into the room. This style of apparatus was not much improved upon till the beginning of the 19th century when in 1808, Daniel Pettibone, of Philadelphia, took out a patent on a stove for rarifying air by heat. This was followed by the warm air furnace of William A. Wheeler, of Worcester, Mass. (1835); by that of Gurden Fox, of Hartford, Conn. (1835-40); the Blaney and the Culver; the Boynton, made by Richardson & Boynton; the Thatcher, and others. The reduction of the price of furnaces has made their use more common, till now nearly every dwelling-house has one. Furnaces may be divided into two general types, the direct and indirect draft. The better class of direct draft furnaces have a radiator, generally placed in the top. through which the gases pass before reaching the smoke pipe, and usually have but one damper combined with the cold air check. In the cheaper styles of direct draft furnaces this radiator is done away with, the gas passing directly into the smoke pipe, but this system wastes much heat that is utilized by the better grade of furnace. In the indirect draft type of furnaces the radiator is located near the base, and the gases pass down through flues to it, thence upward and through another flue to the pipe. This style of furnace has a direct draft damper in addition to the damper in the pipe, thus allowing the gas to escape to the chimney more easily.

The matter of grates and fire-pots is most important. The most approved form of grate is the revolving triangular pattern, consisting of teethed triangular bars, connected by gears and turned by means of a detached lever. Fire-pots are usually made of cast-iron or of steel plate lined with fire-brick, the pot ranging in depth from 12 to 18 inches. In a wrought-iron or steel furnace, this fire-brick lining is necessary because the intense heat may harm the outside shell, but it has not the advantage of giving off heat when the coal is first put on, as does the furnace having the cast-iron fire-pot.

The combustion chamber, or space above the fire-pot, should be of sufficient size to allow the gases to become thoroughly mixed with the air passing up through the fire or through the openings of the feed door. The radiator, generally constructed of cast-iron or steel plate, is used as sort of a reservoir for the gases and air passing over the furnace, till the air has extracted a considerable portion of the heat from the gas. The cold-air box should be large enough to supply a volume of air sufficient to fill all the hot-air pipes at the same time, the general size or area of the cold-air box being three-fourths the combined area of the hot-air pipes.

Steam.—Heating by means of hot-water has been in use since time immemorial, and was known prior to the Christian Era, for Seneca mentions the methods by which water was heated in the Thermæ at Rome, that of passing water through a coil of brass pipes which passed through a fire. This method was used in France, in 1777, by M. Bonnemain, and in London, in 1817, by Marquis de Chatannes, for heating a conservatory, and in 1822, an Englishman, named Bacon, introduced the method of using an inclined pipe of large dimensions, but this was not successful because of imperfect circulation. The first hot-water apparatus introduced in this country was the Perkins system, introduced from England by Joseph Nason, in 1842. Hot-water heating in the United States has been an evolution of the past 25 years, the most popular heaters at the beginning of this period being the Gurney and the H. B. Smith. In 1885, the Bolton heater was introduced by the Detroit Heating & Lighting Company, the Mouat heater was the next in succession, and since that time the improvements have been so many and the demand so great that the price of the hot-water plant has been reduced till it is within the reach of the average householder.

The practice of heating buildings by steam was begun about 1845, the first building to be so heated being the Eastern Hotel, of Boston, and the first factory building, the Burlington, Vt., Woolen Mill. The system by which these buildings were heated was introduced by Joseph Nason, and consisted of small wrought-iron pipes, three-quarters of an inch in diameter. From this small beginning have developed the many intricate systems of apparatus now used for warming buildings.

There are two systems of heating by steam, the direct and the indirect, the former being used in all classes of buildings, both by itself and in combination with other systems. The direct system consists of a furnace and boiler for the combustion of fuel and the generation of steam; a system of pipes, by means of which the steam is conveyed from the boiler to the radiators and the condensed water returned to the boiler; and the radiators or coils of pipes placed throughout the rooms of a building for the purpose of diffusing the heat to the air. The types of boilers used are many and various; the cast-iron sectional boiler is more commonly used for dwelling-houses, and the tubular or water-tube boiler for larger buildings. In the boiler used for heating purposes only it is not necessary to carry a pressure of more than 2 to 10 pounds, the condensation flowing back to the boiler by gravity. When under a high pressure, the steam for the heating system is forced through a reducing valve and the condensa-

Digitized by Google

tion returned to the boiler by means of a pump or return trap. The system of diffusing the heat by radiators is not standard, no particular one being of greater benefit than another. There are the common cast-iron sectional radiator; the vertical wrought-iron pipes screwed into a cast-iron base; the cast-iron wall radiator, which does not obstruct the flow; and the unsightly coils of wrought-iron pipes placed along the ceiling or walls.

Indirect steam heating has the advantages both of the furnace and of the direct steam, but the cost of installing the system is greater. The main difference between the two lies in the radiator, in the indirect system a special form of heater being placed beneath the floor and encased in galvanized iron or brick work. Connected with the space beneath the heater is a cold-air box, and warm-air pipes at the top are connected with registers in the floors or walls as previously described for furnaces, so that the air in passing through the spaces between the sections of the heater becomes warmed and rises to the rooms above. As compared with furnace heating this method has one great advantage, being less affected by outside wind pressure, as long runs of horizontal pipe are avoided and the heaters can be placed near the registers.

The statistics for the manufacture of steam fittings and heating apparatus are as follows: Number of establishments, 176; capital, $28,541,509; salaried clerks and officials, 1,491; salaries, $1,857,617; wage-earners, 11,690; wages, $6,581,578; miscellaneous expenses, $2,728,067; cost of materials used, $10,425,332; value of product, $24,910,857. See FURNACE; HEATING AND VENTILATION; FUEL ELECTRIC FURNACES; Etc.

Stowe, Calvin Ellis, American educator: b. Natick, Mass., 6 April 1802; d. Hartford, Conn., 22 Aug. 1886. He was graduated at Bowdoin College in 1824, and at Andover Theological Seminary in 1828. In 1829 he became an editor of the Boston *Recorder*, but abandoned journalism for the chair of Greek at Dartmouth in 1830. In 1832 he was called to Lane Theological Seminary, Cincinnati, and in the same year was married to Harriet Elizabeth Beecher, author or ‹Uncle Tom's Cabin.› He was professor of divinity at Bowdoin in 1850, and in 1852 became professor of sacred literature at Andover, retiring in 1864. His writings include: ‹The Hebrew Commonwealth› (1829); ‹Lectures on the Sacred Poetry of the Hebrews› (1829); ‹Introduction to the Criticism and Interpretation of the Bible› (1835); ‹Origin and History of the Books of the Bible› (1867); and other works.

Stowe, Harriet Elizabeth Beecher, American writer: b. Litchfield, Conn., 14 June 1811; d. Hartford, Conn., 1 July 1896. She was a daughter of Rev. Lyman Beecher (q.v.), and sister of Henry Ward Beecher (q.v.). She was educated at Litchfield and then at Hartford, under her sister Catherine, whom she joined in teaching in her school there. In 1832 the sisters removed to Cincinnati, where their father was appointed president of Lane Theological Seminary. In 1836 she was married to the Rev. Calvin E. Stowe, a teacher in the seminary, who in 1850 removed to Brunswick, Maine, on being appointed a professor in Bowdoin College, soon after exchanging this post for a similar one at Andover. She had become familiar with the evils of slavery during her residence at Cincinnati, and the work by which her work became known throughout the world —‹Uncle Tom's Cabin›— was a direct attack upon slavery, and was (in 1851–52) contributed in serial form to ‹The National Era,› an anti-slavery newspaper published at Washington. The story was to some extent based on the experiences of Josiah Henson (q.v.). It was defective in style and construction, but was vividly done. It did not perfectly render Southern life, and the injustice of some of its presentations has been much discussed. It certainly helped to liberate the slave, though its effect was enhanced by political conditions. It became almost immediately famous, was translated into many foreign languages, and published in innumerable editions. In 1879, when the ‹Illustrated› edition was published, there were in the British Museum 43 English editions and 19 translations. None of her subsequent works attained anything like the same popularity. Among her other works may be cited ‹Sunny Memories of Foreign Lands› (1854); ‹The Mayflower, and Miscellaneous Writings› (1855); ‹Dred: A Tale of the Great Dismal Swamp› (1856); ‹The Minister's Wooing,› her most artistic work (1859); ‹The Pearl of Orr's Island› (1862); ‹Agnes of Sorrento› (1862); ‹Reply to the Address of Thousands of Women of Great Britain and Ireland to their Sisters of the United States› (1863); ‹House and Home Papers› (1864); ‹Stories about our Boys› (1865); ‹Little Foxes› (1866); ‹Religious Poems› (1867); ‹Queer Little People› (1867); ‹Daisy's First Winter, and Other Stories› (1867); ‹The Chimney Corner› (1868); ‹Men of our Times› (1868); ‹Oldtown Folks› (1869), a popular study of New England life; ‹The American Woman's Home› (1869), with Catherine E. Beecher; ‹Lady Byron Vindicated› (1870); ‹Little Pussy Willow› (1870); ‹Pink and White Tyranny› (1871); ‹Sam Lawson's Fireside Stories› (1871); ‹My Wife and I› (1871); ‹Lives and Deeds of our Self-Made Men› (1872); ‹Palmetto Leaves› (1873); ‹Woman in Sacred History› (1873); ‹Betty's Bright Idea, and Other Tales› (1875); ‹We and our Neighbors› (1875); ‹Deacon Pitkin's Farm, and Christ's Christmas Presents› (1875); ‹Footsteps of the Master› (1876); ‹Captain Kidd's Money, and Other Stories› (1876); ‹The Ghost in the Mill, and Other Stories› (1876); ‹Poganuc People› (1878); ‹A Dog's Mission› (1881). Consult, ‹Life,› by her son (1889); Field, ‹Life and Letters of Harriet Beecher Stowe› (1897).

Stowell, stō'ĕl, **Charles Henry**, American physiologist: b. Perry, N. Y., 27 Oct. 1850. He was graduated from the Genesee Wesleyan Seminary in 1868 and from the medical department of the University of Michigan in 1872, where he became lecturer and professor of physiology 1876–85. He has published, ‹Primer of Health›; ‹A Healthy Body›; ‹Microscopical Diagnosis›; ‹Structure of Teeth.›

Strabis'mus. See VISION, DEFECTS OF.

Strabo, strā'bō, Greek geographer: b. Amasia 54 B.C.; d. 21 A.D. He received a good education, and adopted the stoical philosophy. He was with Ælius Gallus in Egypt in 24 B.C. He wrote a historical work in 43 books, which is

Digitized by Google

lost. It formed a continuation of the history of Polybius to the battle of Actium. The extant fragments of it are collected in Müller's 'Fragmenta Historicorum Græcorum.' His great work on geography, in 17 books, has been preserved entire, with the exception of the seventh book, of whch there is only an epitome. It includes notices of important political events, and of chief cities and their great men. Eight books are given to Europe, six to Asia, one to Egypt and Libya. The best critical edition is that by Kramer (Berlin 1844). Consult, Dubois, 'Examen de la Géographie de Strabon' (1892).

Strachey, strā'chĭ, **John Saint Loe,** English journalist: b. 1860. He was educated at Oxford, and has been a London journalist from 1884. He was editor of the 'Cornhill Magazine' 1896-7, and is now editor and owner of 'The Spectator' and proprietor of 'The Country Gentleman.' He has published 'From Grave to Gay.'

Strachey, William, English colonist and historian: b. England about 1585. Nothing definite is known of him before the sailing of a party of colonists, 15 May 1609, bound for Virginia. He sailed in the Sea Venture, which was wrecked on the Bermudas in July. An account of the wreck was written by Strachey and published in 'Purchas his Pilgrimes' (1625) under the title 'A True Repertory of the Wracke and Redemption of Sir Thomas Gates upon and from the Islands of the Burmudas, his coming to Virginia and the state of that Colony.' Strachey and his party finally reached Jamestown, 23 May 1610, where he was appointed secretary and recorder of the colony by Lord De la Warr. He returned to England in 1611 and he edited the laws promulgated for Virginia by Sir Thomas Gates and Sir Thomas Dale, 'For the Colony in Virginia Britannia Lawes Divine, Morall and Martiall, Alget qui non ardet' (1612). His larger work on Virginia, 'The Historie of Travaile into Virginia Britannia, expressing the Cosmographie and Comodities of the Country, Together with the Manners and Customes of the People. Gathered and Observed As Well by those who went First Thither, As Collected by William Strachey, gent. Three Yeares thither Imployed Secretarie of State,' failed of finding a publisher during his lifetime and was brought out by the Hakluyt Society in 1849. This is regarded as the most ably written of the numerous accounts of the settlement of Virginia. Nothing is known of the history of Strachey subsequent to 1618 when he tried unsuccessfully to interest Bacon in the publication of his book.

Stradella, Alessandro, Italian singer and composer: b. Naples 1645; d. Genoa 1681. After receiving his early musical training at Naples, he subsequently went to Venice, and thence to many other cities of Italy where he was greeted with enthusiasm. He was constantly threatened with death or injury by the rivals to whom his triumphant success was intolerable. While he fortunately escaped from the hands of his would be assassins at Rome, he was severely wounded by bravos at Turin, and an attack made upon him in Genoa proved fatal. The most exquisite of his many compositions is the oratorio 'San Giovanni Battista.' Flotow's opera of 'Stradella' is concerned with the career of this composer. Consult: Richard's 'Stradella et les Contarini' in the Paris musical journal 'Le Ménestrel' (1865 No. 51; 1886 No. 18).

Stradivari, strā-dē-vä'rē, **Antonio,** Italian violin-maker: b. Cremona 1649; d. 1737. He was a pupil of Nicolo Amati, in whose employment he remained until about 1679, when he began making on his own account. It was he who settled the typical pattern of the Cremona violin, and his instruments, for tone and finish, have never yet been excelled. His improvements consisted chiefly in lowering the height of the arch of the belly, in making the four corner-blocks more massive, in giving greater curvature to the middle ribs, in altering the setting of the sound-holes, and in making the scroll more massive and prominent. He reached his greatest perfection in his art about 1714. He also made many other kinds of musical instruments, but it is on his violins of all kinds that his fame rests.

Strafford, străf'ōrd, **Thomas Wentworth,** 1st Earl of, English statesman: b. London 13 April 1593; d. by execution Tower Hill 11 May 1641. Entered at St. John's College, Cambridge, in 1607 he became a student of the Inner Temple, and in 1611 received the honor of knighthood. He was returned for Yorkshire to the Parliament which met 5 April 1614, and in 1621 he was again chosen. On the convening of the new Parliament he was one of the six popular members who were prevented serving their country in that assembly, by being appointed sheriffs for their respective counties. When Charles, among other expedients for raising money, had recourse to a forced general loan, Wentworth refused to pay his contribution, and was first imprisoned in the Marshalsea. In 1628 he took his seat for Yorkshire, and became one of the most conspicuous advocates of the petition of right. In 1628 he was created Baron Wentworth, and some months afterward a viscount and privy-councillor, and on the resignation of Lord Scrope nominated President of the North. The assassination of Buckingham soon after removed an obstacle to his further promotion, and he became so influential in the king's council that his powers in the four northern counties over which he presided was enormous. The legality of some of the powers of the Council of the North, created by Henry VIII., had been questioned by judges in the reign of Queen Elizabeth, and these powers had been greatly increased at the instance of Wentworth. He was selected by Laud to proceed to Ireland as lord-deputy in 1632. He greatly improved the state of the country, both as regarded law, revenue, and trade. By a considerable outlay at his own risk he introduced the growth of flax, established looms, brought workmen from France and Flanders to work them, and thus endowed the country with a new and most valuable industry. But, at the same time, nothing could be more arbitrary than his system of government, it being his boast that he had rendered the king as absolute in Ireland "as any prince in the whole world could be." He returned with the full title of lord-lieutenant, with a view to gain subsidies and troops, in which he fully succeeded; and again repairing to England, took the command in the north, but found himself obliged to retire before the Scottish army, and retreat to York. The very first movement of the party opposed to arbitrary power

Digitized by Google

was to impeach him for high treason, with which charge Pym appeared at the bar of the House of Lords in November 1640. The articles of impeachment, at first 9 in number, were afterward increased to 28, the object of which was to convict him of an attempt to subvert the fundamental laws of the country. As in the case of Laud, it was easy to prove that he acted as a friend and promoter of arbitrary measures, but not to substantiate any particular fact to justify a capital charge. There can be no doubt, however, that his design was to subvert the fundamental laws and liberties of his country, and to enable the king to rule absolutely and without control. Although treated with the extreme of legal rigor, and debarred the assistance of counsel, his own great abilities and force of mind supplied every deficiency; "And never man," says Whitelock, the chairman of the impeaching committee, "acted such a part, on such a theatre, with more wisdom, consistency, and eloquence, or with greater reason, judgment, and temper." His defense, indeed, was so strong that the original impeachment was deserted for the unjustifiable proceeding of a bill of attainder. The bill passed the Commons by a great majority, and was carried in the Lords by a feeble one. The king, who had imprudently endeavored to stop the bill by his personal interference, had not sufficient firmness to redeem the pledge of safety which he had previously given, but yielded to the advice of his counsellors, backed by a letter from Strafford himself, who urged him, for his own safety, to ratify the bill. Browning's 'Strafford: An Historical Tragedy' (1837), is based on his career. Consult: 'The Earl of Strafford's Letters and Despatches' (1739), and the biographies by Forster (1836; in Vol. I. of his 'Statesmen of the Commonwealth') and Cooper (1866).

Straight University, located at New Orleans, La. It is open to pupils of both sexes without regard to race or nationality, and was the pioneer school in Louisiana to provide educational privileges for the negro race. It was founded in 1869 by the American Missionary Association (Congregational), and its first building was erected by the United States government. At first it offered only courses of elementary and secondary grades, but as the work steadily prospered higher departments were added. The organization now includes: (1) the Daniel Hand Primary School; (2) the Grammar Department; (3) the College Preparatory Department; (4) the Industrial Department; (5) the Normal Department; (6) the College Department; (7) the Department of Music; (8) the Theological Department. There is also a night school connected with the University. The College Department offers two courses, classical and Latin scientific, and confers the degrees of A.B. and B.S. The preparatory department provides two corresponding secondary courses. The normal course requires four years' study beyond the grammar grades, but the first year's course is identical with the first year of the College Preparatory Department. The Theological Department provides courses for those who are graduates in a classical course and for those who have had only English courses; there is, in addition, a course in Bible Study. Industrial training is given only in connection with the regular school work. The courses in the Industrial Department are: Domestic science, open to girls in the 8th grammar grade and the College Preparatory Department, sewing and dressmaking extending through the 4th, 5th, 6th, 7th, and 8th grades; wood-working, a systematic course extending through the 5th, 6th, 7th, and 8th grades; mechanical drawing, required in the first year of the normal and the third year of the college preparatory course; printing, open to all students of the College and Normal departments. The university has a central location; the buildings include the main building, replacing the former building destroyed by fire in 1891, Stone Hall, a dormitory for girls, and Whitin Hall, a dormitory for boys. The library contained in 1910 over 2,500 volumes. The university depends partially for its support on the American Missionary Association; its productive funds in 1910 amounted to $10,700. The tuition fees are small, and the older students are allowed to pay a part of their expenses by doing extra work. The total attendance in 1910 was 644; College Department, 9; Normal Department, 92.

Strain, Isaac G., American naval officer: b. Roxbury, Pa., 4 March 1821; d. Aspinwall, Colombia, 14 May 1857. He was appointed midshipman in the United States navy in 1837; in 1845 led an exploring expedition into the interior of Brazil and in 1849 made the overland journey from Valparaiso to Rio Janeiro. He received rank as lieutenant in 1850, was engaged in that year with the commission which laid out the boundary line between United States and Mexico, and in 1854 was in charge of the expedition for the survey of the Isthmus of Darien. The extreme hardships which his command was called upon to endure in this latter expedition and the skill and courage with which Strain met the difficulties that beset him brought him favorably before the public. He was assigned to the Arctic in 1856 and was engaged in making soundings in the North Atlantic Ocean for the purpose of ascertaining the possibilities of laying a submarine cable between United States and Great Britain. He wrote: 'The Cordillera and Pampa' (1853); 'The History and Prospects of Interoceanic Communication' (1856). Consult Joel Tyler Headley, 'Darien Exploring Expedition, Under Command of Lieutenant Isaac G. Strain, U. S. N.' (1885).

Strait of Magellan. See MAGELLAN, STRAIT OF.

Straits Settlements, East India, a British colony consisting of several isolated possessions on and adjacent to the Malay Peninsula, and bounded by the Federated Malay States. These possessions are the island of Singapore, the port and territory of Malacca, and the island of Penang, together with Province Wellesley and the Dindings (see articles on the separate settlements). The total area of the colony is 1,246 square miles, and the combined population about 600,000, the greater portion being divided between Chinese and Malays. The colony is administered by a governor residing at Singapore, under whom are British resident councillors at Malacca and Penang. The ports of the colony are all free; the shipping amounts to over 14,000,000 tons, and the trade to about $250,000,000 annually. For further details see MALACCA, PENANG, and SINGAPORE.

Digitized by Google

Strakosch, strä'kōsh, **Moritz,** Austrian pianist and impresario: b. Lemberg, Poland, 1823; d. Paris 8 Oct. 1887. He was educated at Vienna, and came to the United States in 1845, where he was both a teacher and a concert pianist. In 1856 he began the work of opera and concert managing, and introduced to the public Patti, Nilsson, and other famous singers. He also composed several pianoforte pieces, and 'Giovanna di Napoli,' an opera; and wrote 'Memoirs of an Impresario.'

Stralsund, strāl'soond, Germany, in Prussia, capital of the government of Pomerania, and seaport on Strela Sound, 120 miles northwest of Berlin. The town stands on a promontory and presents a picturesque appearance with its wooden-gabled, antique buildings. The town-house (1311) contains an interesting collection of ancient relics from the island of Rügen. There are, besides, several churches, government-house, gymnasium, mint, arsenal, and charitable institutions. The principal manufactures are leather, sugar, starch, oil, and cards. There is considerable trade carried on from the port. Stralsund was founded in 1209 by Saxons; it joined the Hanse Confederation and early attained commercial importance. It has repeatedly suffered severely from war. Wallenstein besieged it without success in the Thirty Years' war (1628). In 1678 Frederick William, the great elector of Brandenburg, took it after a severe bombardment.

Stramo'nium. See DATURA.

Stranahan, străn'ā-an, **James Samuel Thomas,** American park commissioner: b. Peterboro, N. Y., 25 April 1808; d. Saratoga, N. Y., 3 Sept. 1898. He taught school for a year and then became a surveyor. In 1827 he went to the Northwest to trade with the Indians, but his venture proving a failure he returned to Albany and entered the wool business. He founded the town of Florence, N. Y., in 1832 and in 1838 represented it in the assembly. In 1854 he was elected to Congress from Brooklyn to which he had removed in 1844. In 1860 he became park commissioner, which office he held for 22 years, and during this time controlled the expenditure of nearly $9,000,000 for improvements. A bronze statue of him was unveiled at the entrance to Prospect Park 1891. He was actively engaged in the consolidation of New York, Kings, Queens and Richmond counties into the present city of New York.

Strang, străng, **Lewis Clinton,** American dramatic critic: b. Westfield, Mass., 4 Dec. 1869. He was graduated from the Boston University 1892. In 1894 he was assistant city editor and assistant in the dramatic department of the Boston 'Journal' and in the fall of 1898 became dramatic editor. He has published: 'Famous Actresses of the Day' (1899); 'Prima Donnas and Soubrettes of Light Opera and Musical Comedy in America' (1900); etc.

Strange, strānj, SIR **Robert,** English engraver: b. in Pomona, one of the Orkney Isles, 14 July 1721; d. London 5 July 1792. He studied law, attempted a seafaring life, then resolved to devote himself to painting. When the rebellion of 1745 broke out, he joined the forces of the Pretender and was present at the battle of Culloden. To conceal himself from pursuit he wandered for some time in the Highlands, and afterward ventured to Edinburgh, where he subsisted for some time by selling drawings which he had made of the chiefs of the rebellion. He afterward went to France, gained a prize for design at Rouen, and then resided for some time in Paris, where he studied engraving under Le Bas. In 1751 he settled in London, and became the founder of the English school of historical engraving. In 1760 he again visited the Continent and engraved pictures of many of the old masters. He was admitted member of the academies of Rome, Florence, Bologna, Parma, and Paris, and on his return to England in 1787 was knighted.

Strangles, a disease of the horse, ass, and mule, affecting especially young animals. It generally appears between the third and fifth years, and is preceded by cough, with a yellowish discharge from the nostril, and a considerable discharge of ropy fluid from the mouth. This is accompanied by the formation of a tumor under the jaw, beginning about the centre of the channel, and gradually filling the whole space. The disease is sometimes mistaken for glanders, but is easily distinguished by the fact that there is only a single tumor. The tumor gradually swells in the centre, becoming softer until it bursts, when a discharge of pus takes place. The cough then subsides, and the disease rapidly abates, although a considerable time often elapses before the animal recovers its strength. During the progress of the disease the animal suffers considerably from thirst, which it is unable to satisfy by drinking freely, the attempt to swallow bringing on a convulsive cough, from which the disease has its name. Treatment is chiefly directed toward advancing the development of the tumor, on the bursting of which convalescence depends. This is most effectively done by blistering or fomentation. When the swelling becomes soft on the top it should be freely lanced. When it is allowed to burst naturally an ulcer is formed which is very difficult of treatment.

Strangula'tion, violent constriction of the neck, involving such compression of the windpipe as to close the air-passages, prevent respiration, and finally cause death. In hanging, which produces strangulation, if much violence is used, death may be produced by direct injury to the upper part of the spinal cord (q.v.) from fracture or dislocation of the cervical vertebræ, or by syncope from shock, and in such cases must be almost instantaneous; but if the constriction is so applied as to compress the great vessels in the neck and not the windpipe, it is due to coma, and is somewhat slower than in cases of asphyxia. Or if both vessels and windpipe are compressed, coma and asphyxia may both contribute to cause death. When suspension of the body has not continued for much more than five minutes, and the parts about the neck have not suffered violence, there is a probability that resuscitation may be established; though many cases are recorded when after only a few minutes' suspension it has been found impossible to restore life. Moreover, if a person who has hanged himself has been cut down sufficiently soon to allow of the respiratory process being restored, he is by no means safe: death often taking place from secondary effects at various

Digitized by Google

periods. It is believed that unconsciousness comes on very rapidly, and death takes place without causing any suffering; the violent convulsions that are so often observed being similar to those which occur in epilepsy. Exposure to a free current of air, cold affusion if the skin is warm, the application of ammonia to the nostrils, of mustard poultices to the chest and legs, and of hot water to the feet, and the subsequent abstraction of blood if there should be much cerebral congestion — these are good measures in the treatment of partial strangulation, and especially should be used if natural breathing is not at once resumed. From the post-mortem appearances together with circumstantial evidence, the medical practitioner is not unfrequently called upon to answer such medico-legal questions as: Was death caused by hanging, or was the body suspended after death? Was the strangulation the result of accident, homicide, or suicide? In case of strangulation from other causes than that of hanging the post-mortem symptoms are similar, but the injury done to the parts about the neck is commonly greater. In manual strangulation the external marks of injury will be in front of the neck, about and below the larynx; and if death has been caused by a ligature the mark around the neck will be circular, whereas in hanging it is usually oblique. The internal appearances are much the same as in the case of hanging.

Stran'gury, an affection marked by scanty and painful micturition, with a frequent and irresistible desire to pass water. The urinary discharge is accompanied with scalding, cutting pains in the urethra, which sometimes extend to the bladder, the kidneys, and the rectum. Strangury is a variety of retention of urine which may be caused by idiopathic urethrites, by gonorrhœa, or by such irritating substances as cantharides and oil of turpentine, or by gravel or calculus in the bladder. Besides removal of the cause, the following means are useful in treatment: The warm sitz-bath, or hot fomentations over the bladder; an injection of starch and tincture of opium, a wine-glassful of the former to a dram of the latter; and mild mucilaginous drinks of barley or rice water, which may be freely given to render the urine less irritating.

Strap-work, a style of architectural ornamentation or enrichment general in the 15th and 16th centuries, but of which specimens exist executed as far back as the 11th century, consisting of a narrow fillet or band folded and crossed, and occasionally interlaced with another.

Strappa'do, a former military punishment, which consisted in having the hands of the offender tied behind his back, drawing him up by them to a certain elevation by a rope, and then suddenly letting him drop to within a certain distance of the ground.

Strasburg, străs'bĕrg, or **Strassburg,** străs'-boorg, Germany, capital of Alsace-Lorraine, and first-class fortress, on the Ill, two miles west of the Rhine, on the French frontier, 250 miles southeast of Paris. It is cut by the Ill into several sections, and bears a quaint mediæval aspect. The minster or cathedral, the product of four centuries (10th to 14th cen.), is one of the grandest Gothic churches of the Continent. The tall spire (466 feet) rises from the western front, which is richly embellished by statues and bas-reliefs. The screen of double tracery is the work of Steinbach (13th century). The majestic interior is also richly decorated, and of vast dimensions. In the south transept stands the wonderful astronomical clock (14th century), renovated in 1839–42. It includes a perpetual calendar; the relative position and movements of the planets forming the solar system; and many automatic figures which act at stated intervals. Other interesting features of the minster are: the beautiful stained glass and rose-window (42 feet wide); choir-frescoes; a pulpit of 1485, etc. The university (16th century) received a new foundation from the German emperor in 1872. It includes five faculties, has 130 teachers, and an attendance of about 1,000 students. The library contains 700,000 volumes. The main façade faces the imperial palace. Beyond the principal buildings are the various institutes for the exact sciences, the observatory, etc. Others are for the study of experimental physiology, pathology, pharmacy, surgery, eye-clinic, etc. The town also contains several good churches, Hotel-du-commerce, governor's palace, town-house, assembly-room, various museums and collections, benevolent institutions, and a very large railway station. Numerous public squares are embellished by statues, fountains and historical monuments, including busts of Goethe, Gutenberg, and others. The most famous industry is the making of *patês-de-foie-gras* (a meat-pie) whose annual exports have sometimes been valued at the high figure of $400,000. Other industries comprise tobacco, liquor, leather goods, clothing, furniture, carpets, machinery, musical and surgical instruments, artificial flowers, gloves, etc. There is considerable trade, including, besides the above-mentioned articles, wine, corn, tobacco, hops, etc. Transportation facilities by land and water are excellent. The town has always occupied an important military position and has been defended by fortifications of great strength and magnitude. Celts were the first inhabitants, replaced by Romans, and subsequently by the Teutons, and about the 6th century Strasburg became a Frankish possession. This was the commencement of its German connection. Bishops and citizens were in perpetual strife in the early history of the town, and the citizens finally obtained their independence (14th century). In 1681 it was seized by Louis XIV. and became a province of France. In 1870 it was besieged and captured by the Germans and was ceded with Alsace and Lorraine to Germany.

Strat'egy. See Military Science; Tactics.

Strategy, Board of. See Navy of the United States.

Strategy in War. See Military Science, Development of.

Stratemeyer, străt'ē-mī-ẽr, **Edward,** «Capt. Ralph Bonehill,» «Arthur M. Winfield,» American writer of juvenile fiction: b. Elizabeth, N. J., 4 Oct. 1862. He was editor of 'Good News,' 'Young People of America,' and 'Bright Days.' He has published some 50 volumes, among which are 'Last Days of the Spitfire' (1894); 'Oliver Bright's Search' (1895); 'The Young Auctioneers' (1897); 'Fighting for His Own' (1897); 'Fighting in Cuban Waters' (1899); 'Between Boer and Briton' (1900); 'Young Volcano Explorers' (1902); 'Explorers of the Isthmus' (1903).

Digitized by Google

Stratford, Canada, city and county-seat of Perth County, Ontario; on the Avon River, and on the Grand Trunk Railway system; 88 miles west-southwest of Toronto, and 80 miles northeast of Sarnia.

Industries.— The chief industrial establishments are the railway repair shops, saw, planing, flour and woolen mills, foundries, and manufactories of chairs, carriages, bricks, shoes, biscuits and confectionery, cigars, machinery, etc. There are five banks.

Institutions.— The city contains a general hospital, house of refuge, boys' home, numerous churches, a public library, city hall, and courthouse. For educational purposes there are the Provincial Normal School and several public and separate schools.

History, Government, and Population.— Stratford was first settled in 1831, became a borough in 1855, and was incorporated as a city in 1885. Its government is vested in a mayor and a council of 10 aldermen elected annually. Pop. (1901) 9,959; (1910) about 17,000.

Stratford-upon-Avon, ā'vón, England, a market-town in Warwickshire, 94 miles northwest of London, on the Avon. The town comprises an old and a new section, but its chief points of interest are associated with the name and life of Shakespeare. In Henley street stands an unpretentious one-story gabled wooden house, where he was born, and which now belongs to the British government. The house where he died was torn down in 1759. The parish church of Holy Trinity, late Gothic, dates from the 15th century, and Shakespeare's remains were interred in its chancel. There stands to-day a monument and bust erected to his memory.

Anne Hathaway also is buried in this church. A small memorial hall and the interior of the town-hall are dedicated to Shakespeare's memory. The town has a fine guild-hall, a new public library (1905), art gallery, market-house, corn exchange, almshouses, churches for Dissenting denominations, a hospital for infectious diseases, a new school for technical education, public schools, the fine Shakespeare memorial theatre, and the Shakespeare fountain, erected by George W. Childs, the well-known American. The town-hall contains Garrick's portrait by Gainsborough. The visitors to the town are its chief source of wealth. The town owns the gas and water-works, and has constructed an excellent system of main drainage and works for sewage disposal.

Stratford de Radcliffe. See CANNING, STRATFORD.

Strathcona and Mount Royal, Donald Alexander Smith, LORD, Canadian statesman: b. Archieston, Morayshire, Scotland, 1820. He went to Canada in the employ of the Hudson Bay Company in 1838; he spent 13 years on the Labrador coast, and was then stationed in the Great Northwest, where he was promoted to be a chief factor; later he was named resident governor and chief commissioner of the Company in Canada. He first became prominent in public life when appointed special commissioner by the Dominion government to investigate the insurrection at the Red River settlement. In 1870 he was elected to the Manitoba legislature on the organization of that province, and to the Canadian House of Commons, and was also appointed a member of the Northwest Territorial Council. In 1874 he resigned from the Manitoba legislature; and in 1880 lost his seat in the Canadian House. He re-entered public life in 1887, when he was again elected to the House of Commons, remaining there till 1896, when he was appointed to represent the Dominion of Canada in London as high commissioner. At the beginning of his political career he supported Sir John Macdonald, the conservative leader, but at the time of the "Pacific Scandal" in 1873, he transferred his support to Liberals; but after 1878 gave Macdonald independent support in his fiscal and railway policy. He has been actively connected with many industrial and commercial undertakings, but his name is particularly connected with railway development in Canada, especially the organization and success of the Canadian Pacific Railway is due largely to him. In 1886 he was knighted and in 1896 raised to the peerage as Baron Strathcona and Mount Royal. In 1896 he endowed the Royal Victoria College in Montreal for the higher education of women.

Strathcona, Canada, a town of Alberta, Northwest Territories; on the high south bank of the north Saskatchewan River, opposite Edmonton, with which it is connected by a steel bridge. It is the northern terminus of the Calgary and Edmonton branch of the Canadian Pacific Railway, and with Edmonton (q. v.) is the transportation centre for the grain, cattle, and other industries of northern Alberta. There are some manufactures, including flour, oatmeal, butter and cheese, lumber, foundry products, boats, and dredges. Coal is mined in the vicinity. Strathcona has churches, schools, banks, and weekly newspapers. Pop. about 4,000.

Stratton, străt'n, **Charles Sherwood** ("TOM THUMB"), American dwarf: b. Bridgeport, Conn., 4 Jan. 1838; d. Middleborough, Mass., 15 July 1883. He was born of normal parents, and showed no peculiarity until the age of seven months, when he ceased to grow in height. In 1842 he was taken by his mother to P. T. Barnum, and at that time was 28 inches in height, and weighed a little more than 15 pounds, though he later increased in size. He was perfectly proportioned, active, and intelligent; and his exhibitions proved a great success. In 1854 he was taken to England by Barnum and presented to the queen and royal family, and later to Paris, everywhere receiving marked attentions. In 1863 he was married to a dwarf girl, and together they traveled widely and gave exhibitions.

Stra'tum, unit of classification in the scale of geological formations. It is a section of any geological series, composed throughout of the same material as shale, limestone, sandstone, coal, etc. The stratum may be subdivided into beds of which there may be many in a thick stratum. The bed may again be divided into layers, of which there may be several in one bed. A stratum indicates a uniform condition of deposition during its formation. When strata are folded and the tips of the folds worn away, and later other strata deposited upon the eroded or truncated edges of the older strata, the two series are said to be unconformable to each other. When strata are inclined instead of horizontal, the angle of inclination from the horizontal is called the angle of dip, while the direction which the edges of the inclined strata make with a horizontal plane is called the direction of strike

Digitized by Google

The intersection of the stratum with the surface of the land is called the outcrop, and strike and outcrop of inclined strata agree in direction whenever the surface of the land is horizontal.

Straus, strows, **Isidor,** American merchant and communal worker: b. Rhenish Bavaria, 6 Feb. 1845. He arrived in America in his 9th year and settled in Tolbolton, Georgia, and was preparing to enter the West Point Academy, when the Civil War intervened. In 1865 he removed to New York, where his father founded the firm of L. Straus & Sons a year later. In 1888 he associated himself with R. H. Macy & Company of New York, and in 1893 with Abraham & Straus of Brooklyn. Always interested in tariff and currency reform, he was elected 3 Jan. 1894 from the 15th District, New York, to fill the unexpired term of A. P. Fitch to Congress. He is president of 'The Educational Alliance' and a prominent worker in charitable and educational movements.

Straus, Nathan, American merchant: b. Bavaria 31 Jan. 1848, brother of Isidor Straus (q.v.). He settled with his parents in Tolbolton, Georgia, and was graduated from a business college in New York. He then joined his father in the firm of L. Straus & Sons, and since 1888 has been a partner in the firm of R. H. Macy & Company, and since 1892 in that of Abraham & Straus, Brooklyn. He has interested himself actively in civic progress, was appointed in 1893 Park Commissioner, and in 1894 was nominated for Mayor of New York by the Democrats, an honor which he declined. He is well known for his system of sterilizing milk for the poor of the city, which has been adopted in Philadelphia, Chicago, and other places. He has also maintained a system of depots for distributing coal to the poor.

Straus, Oscar Solomon, American merchant and diplomat, brother of Isidor Straus (q.v.): b. Otterberg, Bavaria, 23 Dec. 1850. A resident of Georgia from 1854 to 1865, he was graduated from Columbia University in 1871 and from its law school in 1873. He engaged in mercantile life for a time with his father's firm, but found leisure for literary and educational work. He was appointed United States minister of Turkey 1887-9 and 1898-1900, in 1902, a member of the Permanent Court of International Arbitration at the Hague and in 1906 became Secretary of Commerce and Labor. He is president of the American Jewish Historical Society and has published 'The Origin of Republican Form of Government of the United States' (1886); 'Roger Williams' (1894); 'The Development of Religious Liberty in the United States' (1896).

Strauss, strows, **David Friedrich,** German theologian: b. Ludwigsburg, Würtemberg, 27 Jan. 1808; d. there 8 Feb. 1874. He studied in Tübingen University; became assistant to a country clergyman in 1830; was appointed temporary professor in the seminary at Maulbronn; resigned this position and went to Berlin in 1831 to study under Schleiermacher and Hegel; returned to Tübingen and lectured on logic and philosophy; and published in 1835 his famous 'Life of Jesus,' in which he attempted to prove that the gospel narratives had a mythical origin and growth. To his numerous critics he replied in 'Streitschriften.' and 'Zwei friedliche Blätter.' Appointed in 1839 to the chair of dogmatic theology in Zürich he was prevented from entering upon his duties by a storm of popular indignation, but received a small pension in recompense. His subsequent writings were: 'Christliche Glaubenslehre' (1839-41); 'Life of Schubert' (1849); 'Life of Christian Märklin' (1851); 'Life of Ulrich von Hutten' (1858-60); 'Leben Jesu für das Deutsche Volk' ('Life of Jesus for the German People'; 1877); 'Der Christus des Glaubens und der Jesus der Geschichte' ('The Christ of Faith and the Jesus of History'; 1865); and 'Der alte und der neue Glaube' ('The Old and the New Faith'; 1872), in which he defines his final attitude to Christianity, that being now entirely hostile. His more important works have been translated into English.

Strauss, Johann, Austrian composer of dance music: b. Vienna 14 March 1804; d. there 25 Sept. 1849. He was violinist and assistant conductor in Lanner's orchestra; and in 1824 organized an orchestra of his own, with which he made a number of tours, going to England in 1838; in 1845 he was appointed to conduct the court balls at Vienna. His musical compositions, mostly waltzes, number about 250, and raised the standard of dance music to a high artistic level. Among the waltzes are 'Lorelei'; 'Taglioni'; 'Kettenbrücken'; and 'Donau-Lieder.'

Strauss, Johann, German composer, son of the preceding: b. Vienna 25 Oct. 1825; d. there 3 June 1899. Though his father strongly opposed his musical aspirations, he became conductor of an orchestra in a popular restaurant, after the death of his father uniting both orchestras. He conducted the summer concerts in Petropaulooski Park in Saint Petersburg 1855-65, and the Court Balls 1863-70. 'The Beautiful Blue Danube' is the most celebrated of more than 400 waltzes composed by him, of which many others gained great popularity. He also composed successful operettas, including: 'The Carnival in Rome' (1871); 'Prince Methuselah (1877); 'A Night in Venice' (1883); and 'The Gipsy Baron' (1885).

Strauss, Joseph, American naval officer and inventor: b. Mount Morris, N. Y., 16 Nov. 1861. He was graduated from the U. S. Naval Academy in 1885, and was engaged in hydrographic surveys on the east and west coasts of the United States and in Alaska 1887-90. He spent three years in the Bureau of Ordnance, Navy Department in 1893-6, and here he co-operated with Admiral Sampson in the invention of the superposed turret system of mounting guns on battleships. He was then in charge of the U. S. Naval Proving Ground at Indian Head 1900-3.

Strauss, Richard, German musician and composer: b. Munich 11 June 1864. He studied music at Munich, was made court musical director there in 1886, and became court kapellmeister successively at Weimar (1889), Munich (1895), and Berlin (1898). In addition to songs and chamber-music, he published a symphony (1884); a fantasy for orchestra, 'Aus Italien' (1886); the 'symphonic poems' 'Don Juan' (1889); 'Tod und Verklärung' (1890); 'Macbeth' (1891); 'Till Eulenspiegel' (1894); 'Also Sprach Zarathustra' (1896). 'Don Quixote' (1898), and 'Ein Heldenleben' (1899); and the operas 'Guntram' (1894) and

Digitized by Google

'Feuersnot' (1901). In 1904 he visited the United States, where he appeared as conductor of performances of his works. His programme-music has been the centre of much discussion. Consult Hencker, 'Overtures' (1904).

Straw Manufacture. The use of straw in manufacture is varied and extensive. Besides its use in the making of paper it is woven into hats, baskets, bottle covers, saddles, etc. The most important branch, however, is confined to the hat making. Straw hats were first made and worn by the Romans, but the industry did not receive any impetus until about the 16th century, when Mary, Queen of Scots, engaged a number of straw-plaiters of Lorraine to return with her to Scotland to instruct her people in their art. The principal sources from which the United States imports straw are Italy, China, England, Switzerland, Japan, Belgium, and France. It is estimated that in Saxony and Bohemia there are from 20,000 to 30,000 persons engaged in straw manufacture. The finest straws and braids are imported from Tuscany, where a fine grade of straw is produced, from which the delicate Leghorn braid is made. Some of the braids are so fine, and the work so trying on the eyes and nerves, that a person cannot work steadily at it more than an hour or two at a time. The Panama hat imported usually from Cuba and Porto Rico represents a fine grade of straw as well as skilled workmanship. The prices vary anywhere from $5 to $125. In 1900 there were 5,495 tons of straw manufactured in the United States, valued at $336,287.

Straw'berry, a perennial herb of the genus *Fragaria* (order *Rosaceæ*). The species are natives of the north temperate zone and of the Andes region of South America. They are exceedingly variable, botanists having described about 130 species, which are considered only forms of about 12 species; and even these are reduced by Bentham and Hooker to only four or perhaps three. The number of hybrids — crosses and varieties — is enormous and actively changing annually, as new varieties are introduced into cultivation and inferior ones are discarded. In the United States alone there are probably 1,000 varieties offered for sale each year, and half that number are occasionally tested in a single season at some of the experiment stations. The cultivated strawberries are derived from four species which are characterized by palmate, trifoliate leaves produced upon very short stems often less than an inch long and usually called a crown. The white or yellow, perfect or pistillate, flowers are borne in corymb-like racemes upon scapes which arise from the axils of the leaves. The pistils develop into small hard akenes, «seeds,» persistent upon the enlarged pulpy, edible receptacle, the «berry,» which in some varieties is white, but in the majority red. In Europe the hautbois strawberry (*F. moschata*) is somewhat cultivated for its dull red berries which are noted for their musky odor. They are seldom grown in America. Another European species, *F. vesca,* the alpine or perpetual strawberry, is also cultivated abroad, where its high quality and continuous bearing have rendered it popular in private gardens for which places it should be but is not very popular in America. It is deserving. The scarlet or Virginian strawberry (*F. virginiana*) is a native of eastern North America, where it is the common wild strawberry. It has been cultivated to some extent, but is more or less blended with other species, especially the following. The Chilean strawberry (*F. chiloensis*) is a native of the Pacific coast of South America, with large, dark red, firm, fragrant fruits, which through its botanical variety, *F. chiloenses,* var. *ananassa,* the pine or common garden strawberry, is the parent of the vast majority of horticultural varieties cultivated in America if not throughout the world. This species was introduced into cultivation early in the 18th century.

The first successful American variety, the Hovey seedling, was introduced in 1834 or 1835 up to which time the European varieties had been cultivated in gardens. But not until 1854, when the Wilson or Wilson's Albany was introduced, can strawberry growing be said to have gained a footing upon a commercial scale. This firm-fleshed, large-berried variety quickly proved itself adaptable to a great variety of soils throughout the whole country, and its wonderful productivity led to its extensive planting. The growth of the industry has been so rapid and has reached such proportions that one writer asserts that probably more strawberries are shipped into New York in a day during the busy season than appeared in its markets during its history up to 1840. Commencing in Florida and the Mississippi Delta during February or earlier the strawberry «season» travels northward to Canada where it closes in July. And during this «season,» which lasts usually from two to three weeks in a locality, there are often trainloads of berries sent to market each day. In some of the more important regions such as the coastal plain of North Carolina, the Chesapeake Peninsula and western New York, the rate often reaches a carload a day for each mile of railroad through the shipping district. The berries are mostly used as dessert, but immense quantities are used for canning and for making jams and jellies. Various beverages and fruit syrups are also made from them.

Strawberries are propagated by means of seeds, division of the crown and by runners. New varieties are almost invariably grown from seeds, no two of which from the same fruit can be reasonably expected to produce plants identical as to vigor, productivity, season of maturity, etc., and among which if taken from ordinarily good fruits the proportion of valuable new varieties is probably less than one in 10,000. With seeds produced by hand-pollination of individual blossoms, and under the most careful management, the proportion may be one in 1,000 seedlings. All or almost all of the improved varieties have been produced in this way, only a very few being obtained by selection of individual plants, though this method is really operative more or less unconsciously in all plantations. Division of the crown is very rarely practised with American varieties but is more common with European. It consists in cutting the old plants apart so as to have roots with each part; after management is about the same as for runners. Probably less than one tenth of one per cent of the strawberry plants grown in America are grown by other methods than by runners, which are produced freely by most varieties and will become independent plants

Digitized by Google

usually within three or four weeks if covered with earth. When rooted they may be dug, trimmed and planted, care being taken to place the crown level with the surface of the ground. Sometimes they are rooted in pots for planting in autumn. In such cases they may be allowed to fruit the following season, and are usually allowed to bear two crops before being turned under, since they are more costly, and since the ground is generally cleaner by this method of management than by the common one. Sometimes the runners are dug in the spring, planted closely in nursery beds for a month, during which the soil is thoroughly worked to get rid of weeds and make it fine, and the plants which have developed numerous roots set preferably just before a shower.

Strawberries will succeed well upon almost any soil except the sandiest and the undrained mucky soils. They thrive best, however, upon rich sandy loams well drained but moist rather than dry. These may be anywhere in the United States or Canada where corn will mature and even in some places where the season is too short or the nights too cold for that. They should not be planted upon low ground, since in such places the blossoms are frequently destroyed by late spring frost unless expensive precautionary measures are taken. High land from which the cold air will readily descend, and upon which the flowers may open somewhat later, especially if the exposure be to the north, should be given the preference. If the soil has been in sod for several years it should be planted to corn or potatoes for at least two years to permit the ground to be brought into perfect condition and to allow the larvæ of various root-feeding insects a chance to escape, otherwise they, being deprived of their natural food, may injure the strawberry plants. During these two years liberal applications of stable manure should be given and the ground made as free from weeds as possible by thorough cultivation. If a crop of early potatoes be grown they may usually be harvested in time to allow autumn planting, and except for harrowing, the land may not need further preparation. Usually, however, spring planting is preferred, the ground being plowed as deeply as practicable without turning up the subsoil. It is then harrowed and marked off in rows about 30 inches apart and the plants set by hand or, upon a large scale, by transplanting machines. During the first season most growers destroy the blossoms because it is considered that fruit bearing this season stunts the growth and impairs fruitfulness during the succeeding year. Since the plants are low growing and unable to fight weeds and also produce well, clean cultivation is essential throughout the growing period. After the fruiting season runners will appear (often they come earlier) and should be allowed to root so as to form a more or less continuous row which by the end of the autumn should be about 18 inches wide. Some growers who supply fancy markets or special customers grow the plants in «hills» or «stools,» the runners being destroyed and the original plant encouraged to develop additional crowns. As soon as the ground freezes a mulch of marsh hay, straw, pine needles or other material free from weed seeds, is spread liberally upon the plants to keep the frost in the soil and prevent heaving of the plants and the consequent breakage of the roots. In the spring this mulch is either removed entirely from the field or is raked between the rows. In the former case one or two cultivations are usually given; in the latter, none. Either at this time or during the previous summer, or at both times, applications of commercial fertilizers may be made, the kinds and amounts depending upon the grower's idea of the needs of the plants and the richness of the soil. Wood ashes, muriate or sulphate of potash, dried blood, ground bone and superphosphates are favorite fertilizers. Nitrate of soda and sulphate of ammonia must be given with caution since they may tend to an abundant growth of foliage at the expense of fruitfulness. If, however, the leaves are yellowish, one of these should be given as a rule. When the berries have become fully colored they are gathered with the stems on and shipped to market in crates containing 24, 32, or 36 quart boxes. A yield of 200 bushels per acre is not uncommon and more than double that is often obtained by the most careful growers in favorable years. A net profit of $75 to $150 per acre is the general range under good management, and with good markets. As soon as the crop has been gathered the plants are plowed under and the land planted to such crops as cabbage, turnips, beets, or other plants that require only a short season to reach maturity. Sometimes if the land is exceptionally clean, when the crop has been light, or where the plants are especially vigorous, they may be allowed to remain for two seasons; the second crop, however, is usually lighter than the first and the beds are likely to become weedy even under best management. A favorite rotation is corn, potatoes, strawberries, cabbage, and grass and clover used for hay one or two years or pastured for several.

Strawberries are occasionally forced in greenhouses to supply a small demand among the wealthy. The plants are usually grown in pots because they can be better controlled than in benches and because they may be sold for decorative purposes as well as for dessert. They are generally potted in early spring and the first runners from them rooted in small pots which when full of roots are discarded for large pots in which these plants are to bear fruit. The pots are then kept in deep beds of ashes, preferably under a cold frame in which great care is directed to watering, especially toward and during autumn when it is gradually withheld, the plants even being allowed almost to wilt, in order to shorten up their growth and to store reserve food. After freezing, the plants may be removed as desired to the greenhouse, at first to low temperatures and later to higher ones in imitation of spring. In about eight weeks the fruit should be ready, but all through great care must be exercised in management, especially as to humidity of the air, ventilation, and pollination of the flowers, an operation that must be done by hand with a camel's hair brush, preferably.

Under the best management strawberries are seldom seriously injured by insects, although a considerable number are partial to this plant. The larvæ of several root-feeding beetles are sometimes troublesome, if the grower plants his strawberries upon a freshly turned sod. But this may be obviated by two or perhaps even one intervening crop of potatoes or corn. There are also several beetles which enjoy the blossoms,

Digitized by Google

tender foliage or fruits, but since these travel slowly they may be avoided by selecting new ground each year. There are a few general feeding insects such as caterpillars, plant bugs, etc., which occasionally vary their diet with strawberries, but they are rarely troublesome. Several so-called plant diseases have been reported as causing losses in plantations, but very frequently the cause may be readily traced to other sources, such as planting in unsuitable soil, or upon low-lying land, by insufficient vigor of plant, due to lack of plant food, etc., but especially to continued use of the land for this one crop. All the above may be avoided by proper rotation, the strawberry being allowed to occupy the land only one year or in exceptional cases two years, and the ground being thoroughly cleaned by cultivation and judicious rotation before strawberries are again planted upon it.

Consult: Bailey, 'Cyclopedia of American Horticulture' (New York 1900–2); Farmer, 'Farmer on the Strawberry' (Pulaski, N. Y. 1891); Terry and Roet, 'How to Grow Strawberries' (Medina, Ohio, 1890); Barnard, 'The Strawberry Garden' (Boston 1871); 'Fuller, 'Strawberry Culturist' (New York 1862, and later editions); Pardee, 'Manual of the Cultivation of the Strawberry' (New York 1854, and later editions); and numerous bulletins of the Agricultural Experiment Stations.

M. G. Kains,
Crop Expert.

Strawberry Bass, one of the many local names in the Mississippi Valley of a large and handsome sun-fish (*Pomoxis sparoides*), closely related to and resembling the crappie (q.v.), but having the mottlings a clearer green and tending more to become spottings. It reaches a length of 12 inches, is a favorite game fish for young anglers, is good food, and is abundant in clear cold streams and ponds. Other names are calico bass, grass bass, and bar-fish.

Strawberry Bush. See Spindle Tree.

Strawberry Shrub, a shrub native to the southern United States, which is widely cultivated for its flowers. These are dark purple, terminating leafy branches, with many series of imbricated strap-like sepals and petals. When crushed, they give out a delicious aromatic fragrance, which has been likened to that of strawberries or of fermenting wine. The receptacles are hollow, and enclose the pistils; at maturity, the receptacles enlarge (the bases of sepals, petals, and bracts still adhering) into an urn-shaped capsule holding the true fruits or achenes. The leaves are ovate, rough above and pubescent beneath, and, together with the twigs, have an odor of cloves. Western species of the genus *Butneria* have like aromatic foliage and flowers, but *B. fertilis* bears inodorous blossoms.

Strawboard, the name of a very thick, coarse card board, made of straw after it has been boiled in lime and soda to soften its texture. It is one of the products of paper mills and is manufactured by machinery similar to that used in such mills. The cheaper grades of strawboard are largely utilized in making boxes. The finer qualities are utilized in making book covers. The strawboard industry in the United States is largely confined to Ohio and Indiana.

Streak, in mineralogy, is the essential color of a mineral, or the color of its powder. It is most commonly obtained by rubbing the specimen on a tablet of rough white porcelain or on a piece of white hornstone. Any method may be employed which makes it possible to see the powdered mineral. It is a property of first importance in all schemes for the determination of minerals by their physical properties, and is of especial value in differentiating the metallic minerals, whose external colors are often identical while their streaks may be very different. The greenish-black streak of chalcopyrite instantly distinguishes it from gold whose streak is like its external color. The red or reddish-brown streak of hematite serves to identify it when compared with the ocher-yellow or rust-brown streak of limonite, or the black of magnetite.

Stream Lines. In the flow of fluids (including gases and liquids), the path described by any infinitesimal portion, or particle, of the fluid is called a stream line. The theory of stream lines is a part of the mathematical science of hydrokinetics and is explained in the works cited below. The most important result of this theory is known as the principle of Bernoulli (Daniel). It asserts that in the steady motion of liquids (or fluids of constant density) the sum of the pressure, the kinetic energy per unit volume, and the potential energy per unit volume of the liquid, is constant along a stream line. The principle holds also, with a slight modification of statement, for the case of gases. This principle accounts for the fact that in the steady flow of liquids through tubes of variable cross section the pressure is least where the velocity of the liquid is greatest and vice versa, supposing the potential energy per unit volume of the liquid unchanged. It explains also the action of the Venturi water meter, the aspirator, the ball-nozzle contrivance, and other mechanical devices. Consult Lamb, 'Hydrodynamics'; Appel, 'Traité de Mécanique Rationelle.'

Stream Tin, the name applied to cassiterite when it occurs in the form of sand or small pebbles in the beds of streams or in adjacent bottom lands. Owing to the great hardness, density, and insolubility of cassiterite, it is readily concentrated by running water, and accumulates in extensive deposits, thus constituting an important source of supply of tin ore. It is largely worked in Australia, Tasmania, in the East Indies, and formerly in Cornwall, England. See Cassiterite.

Streator, strē'tėr, Ill., city in Lasalle County; on the Vermilion River, and on the Chicago, B. & Q., the Atchison, T. & S. F., the Wabash, the Indiana, I. & I., and the Chicago & A. R.R.'s; nearly 100 miles southeast of Chicago. In 1868 the place was laid out for a city, and in 1882 it was incorporated. A large part of the city is on high bluffs along the river. It is in a fertile agricultural region in which there is considerable coal, fire-clay, and building stone. The manufacturing establishments include brick and tile works, glass factories, flour mills, machine shops, planing mills, and foundries. The glass manufactures are Bohemian ware, bottles, flint glass, plate-glass, and window glass. The clay products are sewer pipe, tile, and brick. The government census of 1909 gives the number of manufacturing establishments 45; the amount of capital invested, $4,588,000; the number of

Digitized by Google

wage-earners, 1,365; the annual amount of wages, $747,000; the cost of material, $817,000; and the value of the products, $2,137,000. The trade is chiefly in manufactures, coal, grain, livestock, and dairy products. The principal public buildings are the government building, municipal buildings, an opera house, a Y. M. C. A. building, and 25 churches, Saint Mary's Hospital, and a Home for the Aged. The educational institutions are a high school, 18 public schools, four parish schools, kindergartens, private commercial schools, a city library, and the Y. M. C. A. library and reading rooms. The three national banks have a combined capital of $250,000. There are several building and loan associations and a large number of fraternal societies. Pop. (1910) 14,253.

Street, Alfred Billings, American nature poet: b. Poughkeepsie, N. Y., 18 Dec. 1811; d. Albany, N. Y., 2 June 1881. From 1848 until his death he was State librarian of New York. Though diffuse, his verse displays a love of nature founded upon close and accurate observation and scarcely deserved the neglect into which it has fallen. His published works include: 'Fugitive Poems' (1846); 'Woods and Waters,' a volume of Adirondack travel (1860); 'Forest Pictures in the Adirondacks,' poems (1865); 'Frontenac' (1849); 'Drawings and Tintings' (1844).

Street, George Edmund, English architect: b. Essex 20 June 1824; d. 18 Dec. 1881. He was educated in Mitcham and Camberwell, and received part of his professional training under Sir G. G. Scott, and like him held the Gothic style in highest favor, the numerous lectures and papers which he wrote on architecture being all directed to illustrate the history and principles, and promote the progress of that style. His principal literary works are: 'The Brick and Marble Architecture of North Italy in the Middle Ages' (1855); and 'Some Account of Gothic Architecture in Spain' (1865). He was for many years engaged in the work of erecting and restoring churches and other ecclesiastical buildings. In 1868 he was appointed architect of the new Courts of Justice in the Strand, London, after a competition in which were engaged the most famous architects of the day. This gigantic undertaking was not quite completed at his death. In 1866 he was elected an Associate of the Royal Academy, and in 1871 became a Royal Academician. In the last year of his life he was appointed professor of architecture at the Royal Academy. Consult a memoir by his son, A. E. Street (1888).

Street, an open way or thoroughfare within the corporate limits of a city or town. In the rural districts streets are called roads or highways. Most streets are paved. (See PAVING AND PAVEMENTS.) In most American cities streets are from 50 to 100 feet in width. See STREET CLEANING.

Street Cleaning, a term used to include all operations of the Municipal Department charged with keeping the streets free from litter which might affect the public health or comfort, or offend the public taste. In the larger cities of the world the work consists of the daily sweeping of all paved streets; the collection of house refuse — garbage, ashes and light waste — when deposited by the householder in cans on the sidewalk or adjacent thereto; the removal of dead animals from the street; summer sprinkling to lay the dust; and the disposal of snow in winter. In small communities the term covers only the more pressing of these functions — the removal of dead animals and household garbage and ashes, with a spring cleaning of the streets after the melting of winter snows, and an autumn cleaning after the fall of the leaves.

The routine work of street sweeping and the removal of household waste is performed by men regularly employed by the department; while work which varies much with the season, such as the removal of dead animals, street sprinkling and the disposal of snow, is, in most cities, let to contractors who are subject to the call of the department but are better able to supply the frequently sudden demands for large forces of men and teams.

For a long time in Europe, and of late in America, the men of the Departments of Street Cleaning have been protected in their employment by civil service rules which insure their positions during efficiency and good conduct; and in Europe they receive pay during sickness and pensions on retirement. This has had the usual effect of providing a class of men suited to the work and contented with their positions, and in raising to a high order the morale of the Departments. In Europe the men sometimes wear distinctive caps or some other badge of employment, and in Berlin and Turin they wear a modest uniform; but it is evident that the men of any street cleaning force *should* be distinctively garbed to insure for them the respect which is always accorded to members of a uniformed body, and, in the case of street sweepers, to insure their safety from passing vehicles. To Col. George E. Waring, Commissioner of Street Cleaning of the city of New York 1895–7, is due the credit of having clothed all his street sweepers in white, because this is most conspicuous on a crowded street and will conduce most to the safety of the men and the efficiency of the department; and because these uniforms, to be kept white, must be thoroughly washed and always in good sanitary condition. So well has this order served its purpose that the custom has spread to nearly all the large cities of the country, and "white wings" are seen at work on every street.

The degree of cleanliness attainable in any city, and indeed in any street, varies with the character of the people and their education in sanitary matters, and depends largely upon their co-operation. In many of the older and larger cities of Europe — Vienna, for example — where strict obedience to law has long been rigidly enforced, each householder keeps his portion of the sidewalk uniformly and always clean, having it sprinkled and swept twice daily in summer and kept clean in winter; while in New York few householders regard it as a duty and a point of honor to keep their individual sidewalks clean in summer and free from snow and ice in winter. In New York it is not uncommon to see a newspaper dropped on the street with no public protest, whereas in Europe such an act would almost certainly cause a man's arrest if he refused to pick up the paper. There are streets in New York where one sweeper

Digitized by Google

keeps clean 20,000 square yards of pavement; there are other streets, in the crowded districts, where one man's work is to keep clean 1,000 square yards. In the latter case the pavement is laboriously swept seven times daily; and it is to the credit of New York that, as nearly as possible, the streets of the tenement district are as well kept as the streets of the residential portion, though they cost on the average three times as much.

The various elements of difficulty which affect the cost of street sweeping were carefully studied by the late Commissioner Waring, and in his classic report to the mayor of New York at the close of his administration this subject is exhaustively treated. The results are worthy of serious consideration not alone by city administrators but by the people at large. It has been supposed by the public that the cost of street sweeping depends principally upon the kind and condition of pavement, and it has been frequently stated that if all paved streets were surfaced with asphalt the work of the street cleaners would be reduced at least one half; but from Commissioner Waring's investigation it is evident that the character of the pavement is only one, and not the greatest, of several factors in the total. The report considered in succession 13 factors which were deemed to be beyond the control of the department, and for each was determined approximately its relative difficulty. The 13 factors chosen and the relative difficulties determined are as follows:

(1) Kind of pavement — asphalt, 100; wood, 100, brick, 100; granite, 150; Belgian block, 160; cobble, 400.
(2) Condition of pavement — good, 100; fair, 120; bad, 140.
(3) Amount of traffic — light, 100; medium, 140; heavy, 180; dense, 250.
(4) Amount of car track — on basis of 30 foot street with single track.
(5) Kind of car track rail — none, 100; flat or grooved, 110; T rail, 120.
(6) Amount of sanding — little, 110; much, 120.
(7) Amount of sprinkling — heavy, 125.
(8) Elevated railroad — 110.
(9) Character of population — good, 100; fair, 200; bad, 300.
(10) Presence of schools — 110.
(11) Existence of markets — 125; or (12) Push-cart stands — 175.
(13) Vicinity of unpaved streets — 200.

That a street bears heavy traffic is seen to have more influence on the labor of sweeping than that it has granite instead of asphalt pavement. The amount of traffic affects the cost for four reasons: (1) Because of the amount of horse droppings; (2) Because of the dirt of one kind and another which comes from the wagons; (3) Because the passage of horses and wagons effects a solid packing, into crevices, of the dirt upon which they tread; (4) Because of the difficulty of giving close attention to his work when the sweeper must devote a considerable part of his time to dodging horses and vehicles.

But no other single cause contributes so much to the difficulty and expense of sweeping as the action of careless and thoughtless persons in making the public streets the receptacle of all kinds of rubbish — fruit parings, bits of paper, etc.,— of which they wish to be rid, and which a little consideration would induce them to deposit in some can which might be emptied into a cart without the trouble of sweeping and shoveling from the pavement. Of late there has been a marked improvement in this respect in the cities of the United States due to education in matters of cleanliness brought about by the University and College Settlements, the teachers of the public schools, and especially the Juvenile Leagues, which are organizations of children in the crowded districts for the purpose of enlisting their aid in the matter of street neatness.

By measuring the area of each block and multiplying this by the numbers corresponding to its various difficulty factors there was obtained for each block the sum of its principal difficulties expressed in terms of square yards of asphalt pavement, in good condition, with light traffic, with no car-track, with good population, and with all other conditions favorable; and from these was obtained a summation for the territory now covered by the Boroughs of Manhattan and the Bronx; and it is interesting to note how the total requirement of 1,638 sweepers is made up. Were the pavement all asphalt and the population all neat in their habits, were there only light traffic and no street car-track, were there no push carts and no market stores, were every consideration ideal, there would still be required for sweeping the streets a force of 466 men. The density and character of the population on a few blocks of the city make necessary 388 more. The great amount of traffic in some streets calls for 352 extra men to clean up after it. The added difficulty of granite and Belgian pavement requires 200 men, and so with the other factors in lesser amount.

Machine sweepers (horse or automobile) lessen the cost of street cleaning, and may be used to advantage with preliminary sprinkling on wide, level, well paved streets, between midnight and dawn; but their service on crowded streets in daytime is impracticable.

A fall of snow is such an impediment to city traffic, which is usually conducted on wheels even in winter, that it is recognized as a duty of the Departments of Street Cleaning to remove it promptly from important streets, especially from the lines of daily food distribution and from the avenues of daily approach to the business districts. The numbers of men and teams suddenly required are very large, and dumping facilities are in general quite inadequate to the work. The cost is also great — about $125 per mile of street per inch of snow, or $1,250 per mile of street for a ten-inch fall. For these reasons numerous efforts have been made to develop practical processes for melting the snow as it lies, or at least on the block where it lies, and running the water into the nearest sewer opening. Machines for the purpose have been tried in many cities for many years, but have usually proved unequal to the task either because of the cost of melting, or of the slowness of melting, or because the machine could not stand the hard usage to which it was subjected in some streets. It is universally hoped, however, that with continued study and experience some form of snow melting apparatus may be developed to help out the always limited supply of men, carts and dumping facilities, when the traffic of a city is suddenly paralyzed by a heavy snowfall. There is no insuperable difficulty in the matter, because the ordinary cost of removal is at least 30 cents per cubic yard and the cost of fuel should not be one tenth of this.

The benefit of careful and thorough street

Digitized by Google

cleaning throughout the year, and of thorough sprinkling during dry weather, is seen in the improved health of the people, especially of the populous districts where the pavements are the only playground for children. A great betterment in the condition of the streets of the tenement district of New York was effected in the years 1895–7, and to it the medical authorities of the city ascribe the decrease in the death rate from 25.95, 25.30, 22.76 in 1892–3–4 respectively, to 23.18, 21.84, 20.03 in 1895–6–7 respectively. In all street dirt disease germs lurk in unknown numbers, and when the dirt is dry and dust is raised by passing traffic or by winds, the dust and the germs find lodgment in eyes, nostrils and mouths, and the work of disease is begun. Of course the dust and the germs are the thicker the nearer the pavement, and no other cause is necessary to explain why the children of the crowded streets are so affected. Careful experiments lately carried out in New York by Commissioner Woodbury, with germ cultures from plates exposed some at the curb level and some at six feet above, exhibited a wonderful difference in the number of germs which found lodgment on the plates in different parts of the city. At the curb level the evidence of the plates showed on the average five times as many germs as at six feet above. In a tenement district densely populated, where push carts are numerous and traffic heavy, as many as 9,600 germs were caught in a 15-minute exposure of a plate 2¼ inches in diameter. In another part of the city, in a residential district with heavy traffic but well flushed pavement, only 54 colonies were found after a 15-minute exposure.

The relative costs of street cleaning in different cities of the world are impossible of comparison, because the conditions and the standards of cleanliness vary so much, and because the work of the department has nowhere been reduced to an exact science. But in general the cost in Europe is much less than in America because of the greater waste and carelessness of the average American citizen, and because the lower cost of living in Europe and the general introduction abroad of civil service rules enables the departments there to hire men at one quarter the wages paid in America. The cost of street cleaning in Manhattan and the Bronx, including the collection and removal of house waste but not the removal of snow, is about $7,000 annually per mile of street. When the commissioner is competent, this amount of money ensures an excellent condition of the streets; when he is incompetent, the same amount of money is provided and spent, but the citizen suffers. In Vienna, where only some 25 miles of street in the heart of the city is kept thoroughly clean, the annual cost in this section, excluding snow removal, is about $5,000 per mile. In Budapest, where the pavement is excellent and where much value is recovered by sorting the wastes, the annual cost is not far from $2,000 per mile. In Paris it is about the same. In Brussels the cost is about $1,350 per mile. In Birmingham, England, the cost is still less, though wages are higher than on the Continent. See Wastes, City, Disposal of.

C. Herschel Koyl,
Consulting Engineer.

Street Railway Construction. The street railway is an evolution of the stage coach line. The first street railway cars consisted of stage coach bodies mounted on flanged wheels running on flat iron rails. Horses were used as the motive power, although some of the long lines were drawn by steam dummies. The first American street railway was built in New York in 1832, on Fourth Avenue, from Prince Street to Harlem. Between this date and 1873 horse railroads were introduced in all the large American cities. In 1873 the cable system was first put into use on Clay Street, San Francisco, by Andrew S. Hallidie. It had an immediate success and was afterward introduced in Chicago, Kansas City, Saint Louis, Cincinnati, Philadelphia, New York, and other cities. In 1888 the first successful electric street railway was built in Richmond by Frank J. Sprague. From this beginning, the electric railway was introduced in all the cities and towns of the United States, and before the end of the century most of the lines formerly operated by steam or cable were converted to electric traction. Since 1895 the electric method of propelling cars, at first used only in cities, has been applied to suburban and interurban lines and a new industry has thus been developed.

Methods of Propulsion.— The means of propulsion in use on street railways may be divided into (*a*) steam locomotives; (*b*) compressed air; (*c*) cable; (*d*) electricity.

Steam Locomotives.— The steam locomotive is almost entirely abandoned in America. In Europe small dummy locomotives are still used in a number of towns. They are usually encased to hide the moving parts, and are noisy, dirty and inefficient.

Compressed Air.— Compressed air has been used in Chicago and New York as a motive power for street cars, but has never demonstrated its practicability. It is a comparatively inefficient method of propulsion, and the large number of reciprocating parts makes the maintenance of the apparatus high and limits its reliability. Compressed air motors are in use on some of the tramway lines in Paris and other Continental cities.

Cable.— The cable was formerly the motive power on the principal lines in most of the American cities, but since the success of electricity it has been abandoned everywhere except in Chicago and San Francisco. The method of transmitting the power is as follows: An endless steel cable, threaded through a conduit underneath the street between the rails, is driven by steam power in the power plant. Each car or train is provided with a grip which, projecting through the slot into the conduit, surrounds the moving cable. When the gripman wishes to start he tightens his grip by means of a lever, thus causing the grip to clasp the moving rope. When he wishes to stop, he releases his grip enough to allow the rope to slip through it. When he reaches the power plant he opens his grip wide and allows the rope to drop out of it. The rope in the conduit is carried on pulleys placed about 30 feet apart, while in the power plant it is wrapped around drums which are driven by the steam-engine.

On the lines of the Chicago City Railway, the cable in use is one and three eighths inches in diameter, weighs about three pounds per foot

Digitized by Google

and is made up of six strands of steel wire wound around a one-half-inch hemp centre. Each strand is composed of one No. 11, nine No. 12, and nine No. 16 wires. The steel wire has a tensile strength of about 170,000 pounds per square inch, and the cable has a breaking strength of about 65 tons. The driving drums have a diameter of 13 feet and the speed of the cable is 12 and 14 miles per hour. The length of the cables is from four to four and one half miles. The power required to drive the empty cable is 30 horse-power per mile of cable. (A cross-section of the cable conduit of the Chicago City Railway is shown in Fig. 1.)

The cable is particularly well adapted to hilly cities because it does not depend on gravity for traction, the moving cable drawing a car up any grade. On account of the excessive friction load required to pull the empty cable, this system makes the best showing on roads having few curves and a traffic heavy enough to warrant the running of a large number of cars. Under its most favorable conditions, there is no method by which cars may be hauled with so little expenditure of power. The reasons which have caused its abandonment are the large first cost of construction, the lack of flexibility in operating cable lines in connection with lines having other motive power, the liability to long and expensive blockades through the breaking of a cable or an accident to the winding machinery.

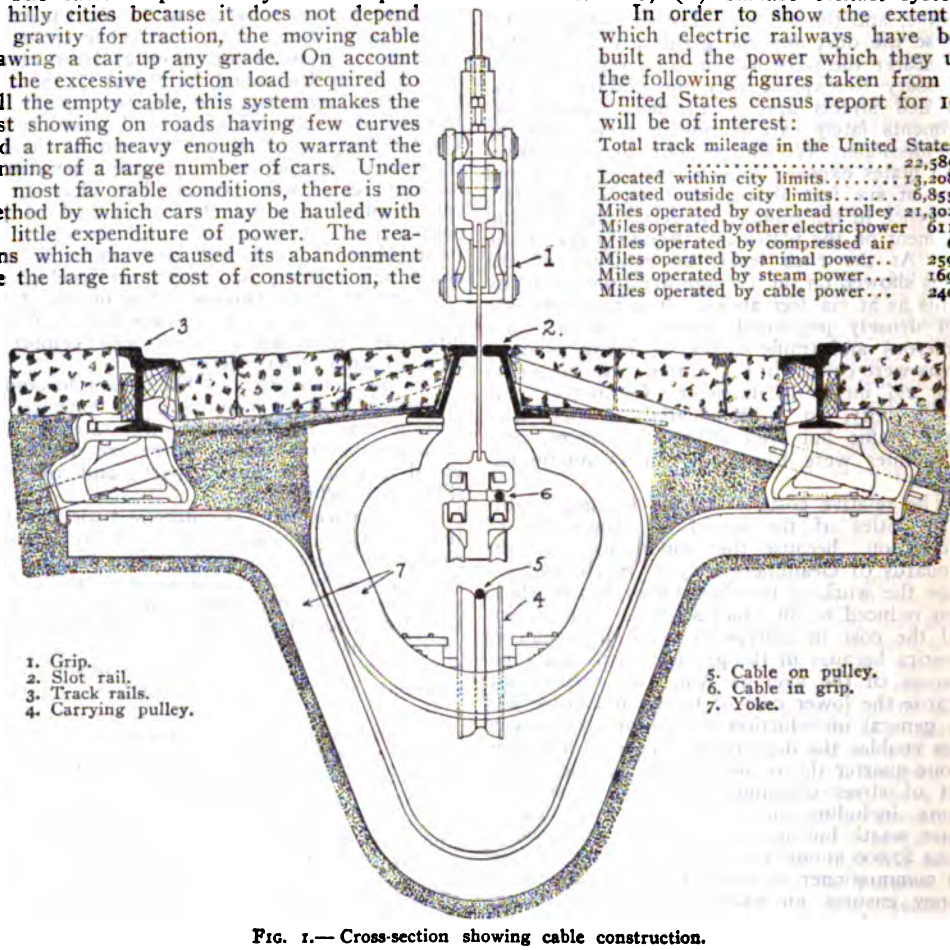


Fig. 1.— Cross-section showing cable construction.

Electricity.— The application of electricity for the propulsion of street cars consists in driving the car axles with motors geared directly to them. These motors run on direct current of between 500 and 600 volts pressure and are connected in parallel between two conductors. Alternating current motors for this class of work are not yet in practical operation. The motors are series wound and have a steel magnet frame entirely enclosing and protecting the armiture. There are two motors on small cars and four on large ones. Iron resistances are used in starting the car, and the two economical speeds are obtained either by running the motors in series or in multiple, which speed changes are accomplished by means of a controller. These features are common to all electric systems and the differences between the various systems consist in the methods used in transmitting the current from the power plant to the car. The systems in use may be classed under the following heads: (*a*) Overhead trolley; (*b*) third rail; (*c*) underground open conduit; (*d*) surface contact systems.

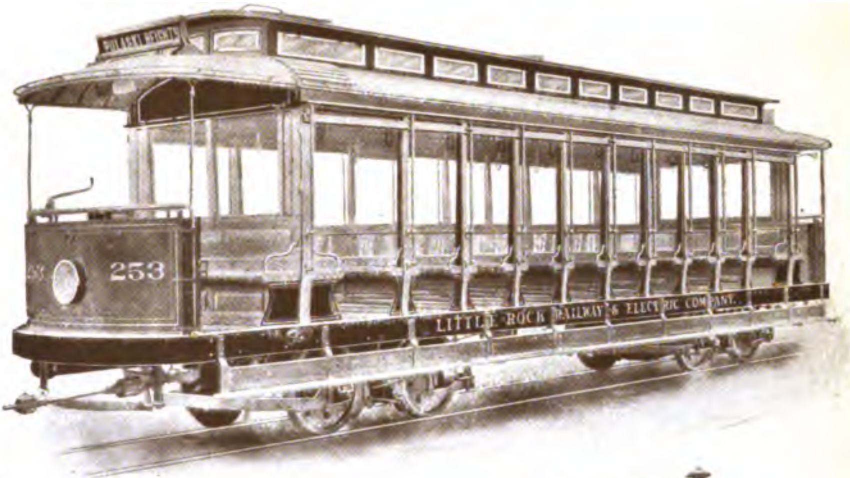
In order to show the extent to which electric railways have been built and the power which they use, the following figures taken from the United States census report for 1902 will be of interest:

Total track mileage in the United States	22,589.47
Located within city limits	13,208.24
Located outside city limits	6,855.58
Miles operated by overhead trolley	21,302.57
Miles operated by other electric power	611.44
Miles operated by compressed air	6.06
Miles operated by animal power	259.10
Miles operated by steam power	169.61
Miles operated by cable power	240 60

Overhead Trolley.— This is the common method of operating electric roads. A copper wire or "trolley wire," as it is called, is supported directly above the centre of the track and at an elevation of about 18 feet above the rails. This wire is supplied with current at intervals by means of a feed wire which runs back to the power plant. Contact with the trolley wire is made from the car by means of an under-running brass wheel carried on the end of a hollow steel pole which is supplied at its lower end with a heavy spring to keep the wheel against the wire. Current is taken from the wire by the wheel, carried down the steel pole

Digitized by Google

8



9

10

8. Double truck car, semi-convertible type. 9. Typical double truck, open car.
10. Typical car for interurban service.

Digitized by Google

Digitized by Google

to the car wiring which is connected to the trolley base. From the trolley base the current passes through the various regulating devices and motors to the axle of the car, from which it passes to the wheel, then to the rail, and flows along the rail to a return feeder, which conveys it back to the power plant. This is the usual path of the current in overhead trolley roads. In Cincinnati two trolley wires are used, one positive and one negative, and the current in this case returns to the power plant over the negative trolley instead of following the rails. Where there is only one trolley wire and the rails are used as a return, the system is said to be "grounded" and the trolley wire is always used as the positive side of the circuit. The advantages of the overhead system are: the relative cheapness of the construction, the rapidity with which it can be built and repaired, and the ease of maintaining good insulation. Its disadvantages are: its unsightliness, its liability to accident from storms, the limited carrying capacity of the trolley wire for heavy service, and the liability of injury to gas and water pipes from electrolysis where the return is "grounded."

two conductors of tee section carried on porcelain insulators about 14 inches from the street surface. In America the conduit is constructed midway between the track rails. In Europe the conduit is sometimes placed directly beneath one of the track rails. A current-collecting device called a "plow" projects through the slot opening and has two cast iron shoes which slide against the conductors. One of these conductors is positive and the other negative, and in this system the track is not used as a return. The feeders are carried in conduits beside the track and at intervals are connected to the conductor bars which in turn are connected by copper bonds. The plow is connected to the car wiring just as in the case of the overhead system. Owing to the great construction cost of this system, it is suitable only in cities having heavy traffic, and except for the æsthetic reason that it removes all overhead wires from the streets, it has no advantages over the overhead system. As it is not a "grounded" system the track rails need not be bonded and there is no danger of electrolysis to gas and water pipes. One of the disadvantages of this system is that if, from poor drainage, the conduit fills with water up to

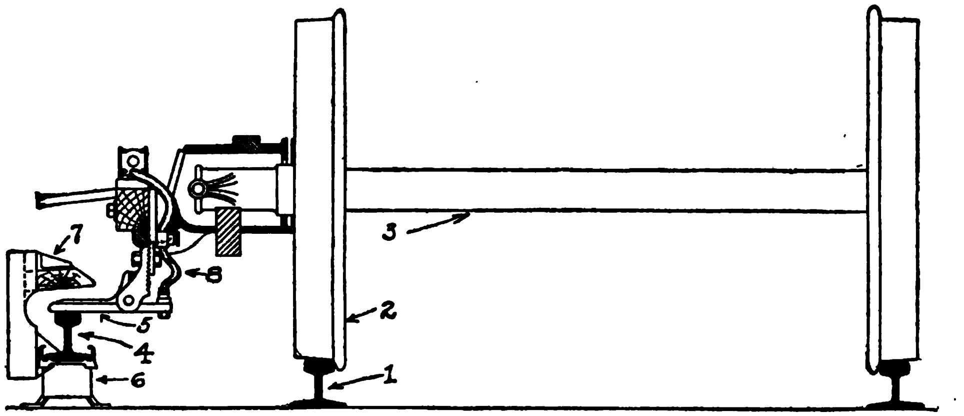


FIG. 2.— Section showing third rail construction.
1. Track rails; 2. Car wheels; 3. Car axle; 4. Third or conductor rail; 5. Sliding contact; 6. Third rail insulator; 7. Protection for third rail; 8. Conductor cable leading from sliding contact to car wiring.

Third Rail.— This system is identical with the overhead system except that a third rail is used as the positive conductor instead of a copper wire. This rail is placed on the ties either between the two track rails or about two feet outside of the rail. A cast iron sliding shoe collects the current from the rail. In most cases a standard tee rail has been used for the conductor, but in some cases special sections have been rolled from a special low carbon steel in order to decrease the electrical resistance of the rail. The third rail is carried on insulators with its top about six inches above the top of the running rail. (Fig. 2 is a diagram illustrating a recent third rail installation.) The third rail system has many advantages for heavy work but manifestly it is suitable only for a road which has a private right of way. Where the rail has no covering, serious difficulty is encountered during the winter on account of sleet storms.

Underground Open Conduit.— In this system a conduit about 24 inches in depth with an open slot three fourths of an inch wide contains the height of the conductor bars, the use of the conduit will be interrupted until the water flows away. (A typical cross section of an open conduit system is shown in Fig. 3.)

Surface Contact Systems.— The method by which all of these systems work is the energizing of certain contacts in the track when covered by the car and the de-energizing of them immediately after the car passes. All such systems involve the making and the breaking of a contact while covered by the car. A great many devices have been invented, but none have had any but indifferent success. As usually constructed a number of steel knobs are placed in the track, six or eight feet apart, upon which rubs a steel shoe fastened to the car. Normally these knobs are inert but when the car covers them a contact with a feeder is automatically made underneath the knob, energizing the knob and allowing the car to draw current from the feeder. As the car passes on, the electrical contact is opened within the knob leaving it inert in the street. None of these systems have ever been put into practical use in America.

Digitized by Google

but several systems of this sort are in use in Europe, notably in Paris and Monte Carlo. They are not successful under severe climatic conditions or with heavy traffic, the difficulty being the failure of the switching device in the knob to close, or its failure to break the circuit, leaving energized knobs in the street after the car has passed, with consequent danger to pedestrians and horses.

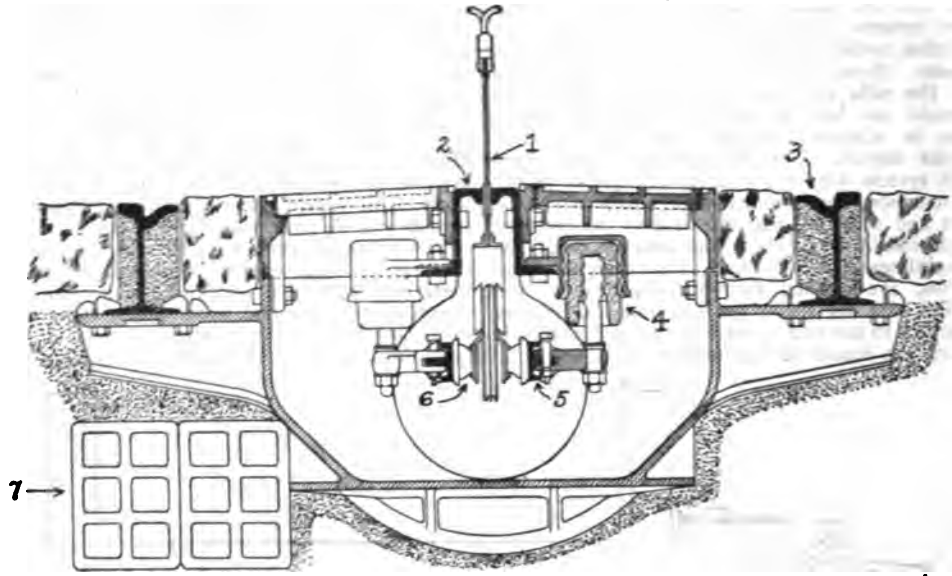


Fig. 3.—Typical cross-section of underground conduit construction.
1. Plow; 2. Slot rails; 3. Track rails; 4. Insulator; 5. Conductor; 6. Sliding contact on plow; 7. Conduit for feeders.

The component parts of a street railway may be put down as follows: Track and roadway. Overhead construction and transmission system. Power plant. Rolling stock. Buildings. (Car houses, repair shops, etc.)

Track and Roadway.— The usual track consists of two parallel steel rails spiked to wooden ties which are tamped with rock ballast. The rail usually employed in American cities is the girder rail from six to nine inches in height. The tee rail is used in Saint Paul, Minn., Denver, Milwaukee and several other cities. In the paved streets of most of the larger American cities some form of the grooved rail is employed, and its use is increasing as many municipalities now require it in paved streets. These various sections of rail are shown in Fig. 4. The weights of rails vary from 60 pounds per yard to over 100 pounds per yard for heavy city work. The standard steam railway gauge of four feet, eight and one half inches is usual, although municipal regulations in some cases establish other gauges. The metre gauge so common in Europe has not been used in America. The standard steam railway wooden tie, six inches in depth, eight inches in breadth, and eight feet long, spaced from two to three feet between centres, is used in good construction. The ties are of hardwood, preferably white oak or chestnut, the locality and the available woods to be obtained governing the choice. In the best practice a steel tie plate is placed between the rail and the tie to prevent cutting of the tie by the working of the rail, and either tie rods or brace tie plates are used to keep the rails in gauge. To obtain a firm and stable roadbed the ties should be laid on at least six inches of crushed stone or gravel, although practice in regard to the amount of ballast used differs

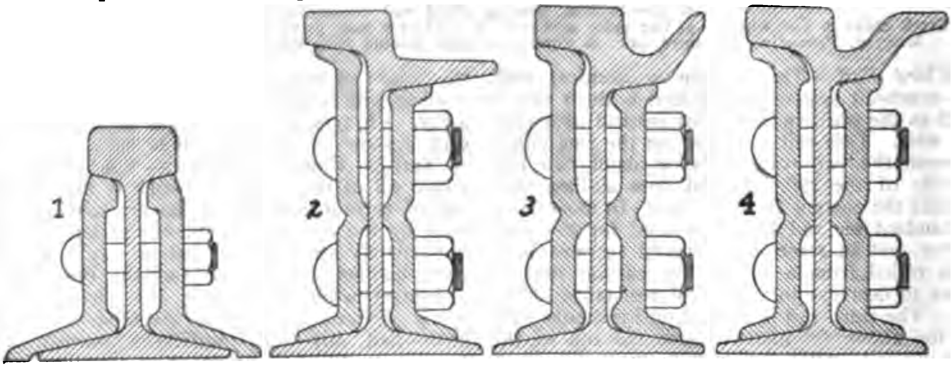


Fig. 4.—Typical rail sections for street railways.
1. Tee rail; 2. Step or girder rail; 3. Three quarter grooved rail; 4. Full grooved or Trilby rail.

Digitized by Google

widely in different localities and among different engineers. Where paving is required, granite blocks six or seven inches in depth make the most economical roadbed, although on account of the expense of this paving, the granite blocks are sometimes replaced by wooden blocks or brick. Where the street is paved with sheet asphalt some municipalities require asphalt paving in the tracks also. In this case it is customary to lay a granite toothing next the rail, to allow access to the track, to take the heavy wagon wheel wear next the rail and to prevent a working of the asphalt caused by the vibration of the rail. The standard 30-foot length of rails is often increased to 60 feet on street railways to reduce the number of joints which are the weak spots in the track. The joints are usually made by means of bolted fish-plates, although there are a number of patented joints which give good results. Rail ends have been welded by means of electricity or by means of molten cast iron poured around the joint. Such a form of construction is good practice in straight track where the paving surrounds the rail and prevents too rapid temperature changes in the rail.

Where it has been desirable to avoid the use of wooden ties, a concrete track construction has been used with good results. A concrete beam about 18 inches wide and 12 inches deep is formed in a trench and the rails laid directly on it. To keep the rails in gauge either tie rods or steel ties are used. This type of construction gives a firm and unyielding roadbed and its use in paved streets is increasing. Since the track rails of most electric railways are used as the return circuit, it is necessary to bond the joints to insure electrical conductivity. The usual method of doing this is to expand by riveting or by hydraulic pressure the terminals of the copper bonds into holes drilled near the ends of the rails. Bonds are made of copper cable and their cross-section depends upon the current density in the rail. It is unusual to use a cross-section smaller than single O (105,500 c.m.), and the usual sizes are two O (133,000 c.m.) and four O (211,600 c.m.). The bonds may be placed underneath the fish-plate or around it. The former plan is probably the better practice. Where the rail joints are electrically or cast welded, it is not necessary to bond the joints to insure electrical conductivity, although this is sometimes done on important lines to insure the conductivity of the rail in case a weld should break.

Curves on street railways are necessarily much sharper than those in steam railway work. The average curve on a street railway is probably about 45 feet radius, but they are sometimes as sharp as 35 feet radius. It is customary to use a special grooved rail for the inside rail and sometimes for both rails of the curve. Frogs, switches and mates are built up of rail sections, made of cast steel, and where the traffic is very heavy are fitted with a wearing piece of hardened steel or manganese steel. Track construction on suburban lines built on a right of way usually follows steam railway practice. Tee rail is used and the ballast is carried only up to the tops of the ties. Table No. 1 shows the standards in use in the track construction in the largest American cities.

TABLE NO. I.—TRACK CONSTRUCTION IN AMERICAN CITIES.

City and Name of Company	Kind of rail for paved streets	Kind of joints	Manner of supporting track—ties or concrete stringers	Manner of holding rails to gauge	What bed under ties	What bed around ties
Baltimore—United Railways & Electric Co....	Grooved	Angle bar (8 bolts)	Ties 6 in. x 8 in. x 8 ft.	Tie rods 6 ft. apart	Sand	Sand
Boston Elevated Railway Co....	Grooved	Angle bar (12 bolts)	Ties 6 in. x 8 in. x 6 ft. 6 in.	Tie rods	Gravel	Concrete
Buffalo Railway Co....	Grooved	Electric welded	Concrete bed and concrete stringers	Ties 5 ft. apart	Concrete	Concrete
Chicago City Railway Co....	Girder	Cast welded	Ties 6 in. x 8 in. x 8 ft.	Brace tie plates	Gravel	Gravel
Cleveland Electric Railway Co....	Grooved	Cast welded and 12-bolt angle bars	Ties 5 in. x 8 in. and 5 in. x 7 in.	....	Concrete	Concrete
Denver City Tramway Co....	Shanghai T	4-bolt angle bars	Ties 6 in. x 8 in. x 6 ft. 6 in.	Tie rods	Gravel	Concrete
Detroit—United Railway....	Grooved	Continuous	Concrete stringers	Ties 30 ins. apart	Concrete	Concrete
Indianapolis Traction & Terminal Co....	Girder and new Shanghai T	Continuous	Ties 6 in. x 8 in. x 7 ft.	Tie rods	Concrete	Concrete
Milwaukee Electric Railway & Light Co....	New Shanghai T	Cast welded	Ties 6 in. x 8 in. x 6 ft. 6 in.	Ties	Concrete	Concrete
Minneapolis—Twin City Rapid Transit Co....	Shanghai T	Cast welded	Concrete stringers	Tie rods 10 ft. apart	....	....
Philadelphia Rapid Transit Co....	Grooved	Zinc	Concrete stringers	Special chair and tie rod	....	....
Pittsburg Railways Co....	Grooved	Cast welded	Ties 6 in. x 8 in. x 8 ft.	Tie rods	Broken stone	Broken stone
San Francisco—United Railroads....	Girder	Cast welded	Ties 6 in. x 8 in. x 8 ft.	....	Concrete (bitumen paving), Broken stone (block pavi'g)	Concrete, Broken stone
St. Louis Transit Co....	Grooved	Angle bar and continuous	Concrete stringers	Dupont tie rod	....	....

Digitized by Google

Overhead Construction and Transmission System.— In city work it is usual to suspend the trolley wire directly above the centre of the tracks on a span or cross wire which is hung on poles erected at the edge of the sidewalk. On double track roads centre poles have been erected between the tracks, and the trolley wire carried on arms extending over the tracks; but this practice is disappearing on account of the obstruction in the street made by the centre poles, and the danger of accidents to passengers. On suburban single track roads the pole is often placed at the side of the track and the trolley wire carried on an arm extending over it. (Fig. 5 shows a typical city construction and Fig. 6 an interurban construction.)

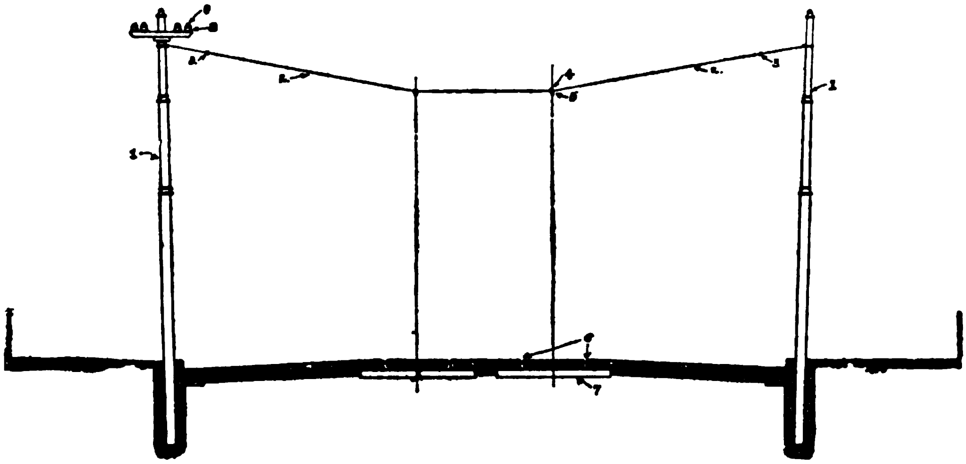


Fig. 5.— Typical double track trolley construction, section across street. 1. Steel poles set in concrete; 2. Span wire; 3. Insulator; 4. Trolley hanger; 5. Trolley wire; 6. Track rails; 7. Ties; 8. Feed wire insulators; 9. Feed wires.

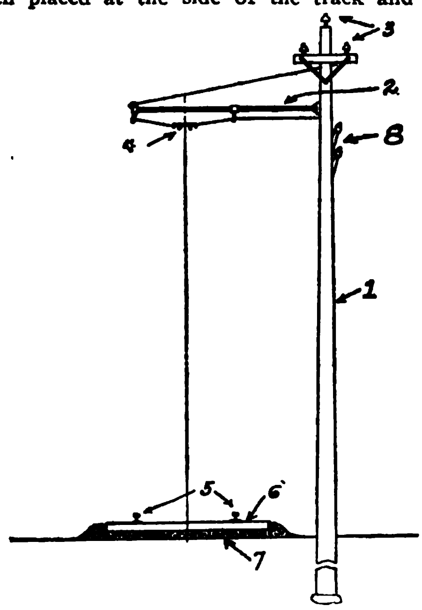


Fig. 6.— Section showing interurban track construction. 1. Wooden pole; 2. Suspension arm; 3. Feeders; 4. Trolley hangers; 5. Track rails; 6. Ties; 7. Ballast; 8. Telephone wires.

As the trolley wire carries a current at a pressure of 500 to 600 volts, it is necessary to maintain a high degree of insulation between the current-carrying wire and the ground. The trolley wire is held up by a brass ear which is clamped or soldered on the wire. The ear is supported by an insulated hanger on the span wire which in turn is fastened through one or more insulators to the poles. In a well constructed system there are three insulations between the trolley wire and the pole. On small roads the trolley wire is single O (105,500 c.m.) in size, while on lines with heavier traffic the trolley wire is larger, being sometimes as large as four O (211,600 c.m.). The usual size in cities is two O (133,000 c.m.). In order to provide a smooth underrunning surface for the trolley wheel, there has been drawn a section known as figure eight wire, having an upper bulb for the suspension and a lower bulb for the contact. Owing to difficulties in erection this section has met with limited use. The material used for trolley wire is principally hard drawn copper about 98 per cent pure, although various alloys such as silicon-bronze and phosphor-bronze have been exploited, with the idea of uniting high electrical conductivity with great tensile strength and hardness. The span wire in common use is galvanized iron cable three eighths of an inch to one half inch in size. The hanger is a malleable iron or bronze casting, containing an insulated bolt which carries the ear. For city work, poles made of two or three sections of steel pipe are common. For suburban work, wooden poles are generally used. The poles are usually 30 feet long and are made of 6–5–4-inch, or 7–6–5-inch steel pipe and weigh from 600 to 900 pounds. Steel poles are usually six feet in the ground in concrete. (Table No. 2 shows the standards in use in the overhead construction in the large American cities.)

In order to isolate trouble arising from leakage or defective insulation, it is customary to divide the trolley wire into sections by means of section insulators placed in the wire. On heavy city lines these sections are one or two miles in length. On lighter lines they are much longer. These sections are fed by individual feeders connecting back to automatic circuit

Digitized by Google

breakers in the power plant which automatically open the circuit in case of an excessive current outflow. Feeders are usually covered with weather-proof insulation and carried on poles beside the track, although it is becoming more and more the custom in cities to place feeders underground in the central part of the city, in which case the feeders are lead-covered cables run beneath the pavement in tile or cement ducts. Copper cable is the ordinary material for feeders, although aluminum cable has been used to some extent, and where the feeders are carried overhead and are not too bulky, aluminum has some advantages over copper. Aluminum has 63 per cent of the conductivity of copper, but has only 33 per cent of the specific gravity, so that weight for weight, aluminum has slightly more than twice the conductivity of copper. The economy of the use of the two metals is regulated by their relative prices.

TABLE NO. 2.— OVERHEAD CONSTRUCTION IN AMERICAN CITIES.

COMPANY	Kind of trolley wire	Size of span wire	Kind and maximum size of feeders (overhead)	Lightest poles for straight line work	Number of insulators between trolley and pole	Type of underground conduit	Volts drop for which new lines are calculated
Baltimore United Rys. & Elec. Co..	Round 0 & 00	5-16 in.	500,000 cm copper	5-4 in.	2	Terra cotta	50
Boston Elevated Ry.............	Round 00	5-16 in.	1,000,000 cm copper	750 lb. 6½-5½-4½ in.	2	Single duct terra cotta	100
Buffalo Ry.....................	Round 00	3-8 in.	500,000 cm copper	....	2	....	100
Chicago City Ry...............	Round 00	3-8 in.	500,000 cm copper	900 lb. 7-6-5 in.	3	Mult. duct terra cotta	75
Cleveland Electric Ry..........	Round 00	5-16 in.	1,000,000 cm copper	625 lb. 7-6-5 in.	..	....	125
Denver City Tramway Co.......	Round 0	5-16 in.	500,000 cm copper	....	2	....	50
Detroit United Ry..............	Round 00	5-16 in.	1,000,000 cm copper	675 lbs.	2	....	100
Indianapolis Traction & Term'l Co.	Round 00	3-8 in.	500,000 cm copper	600 lbs.	2	....	..
Milwaukee Electric Ry. & Light Co.	Fig. 8 = 000	1-2 in.	....	850 lbs. 8-7 in.	2	Single duct tile	..
Minneapolis Twin City R. T. Co...	Fig. 8 = 00	3-11 in.	500,000 cm copper	....	2	Multiple duct tile	25
Philadelphia Rapid Transit Co.....	Round 00	......	....	915 lbs. 8-7-5 in.	2	....	50
Pittsburg Rys. Co................	Round 00	5-16 in.	1,500,000 cm aluminum	....	..	Cement lined and single and multiple duct tile	50
San Francisco United Railroads....	All kinds in use	5-16 in.	1,000,000 cm copper	7-6-5 in.	2	....	100
St. Louis Transit Co............	Round 00	5-16 in.	1,000,000 cm	545 in. 6-5 in.	2	Cement lined iron pipe	100

In order to calculate the cross-section of the feeders required by a trolley section, it is customary to assume a certain loss in voltage at maximum load. Theoretically there is a certain relation between the cost of power and the price of copper which establishes the most economical design, but in calculations this loss is usually assumed at 10 per cent to 20 per cent of the power plant voltage, that is to say, if 550 volts pressure is maintained at the power plant, 10 or 20 per cent of this pressure is lost in the transmission, and the voltage on the trolley wire at the section is 495 or 440 volts at the estimated maximum load. This transmission loss is made up of two parts, the loss in the feeders and trolley wire on the positive side, and the loss in the track and track feeders on the negative side. The track loss may be calculated, knowing the section of rail and the bonding at the joints, assuming that the conductivity of the steel is one ninth that of copper. Having determined the track loss for the estimated maximum load on the section, this loss in volts is deducted from the allowable loss, giving as a result the loss to be allowed in the feeders. The required cross-section of the feeders may then be calculated from the formula,

$$x = \frac{11\,C\,D}{E};$$

where x = the required feeder cross-section in circular mills.
C = the maximum current in amperes.
D = distance from power plant to centre of trolley section in feet.
E = allowable loss in feeders in volts.

In the case of long suburban or interurban lines where on account of their length and cross-section, the cost of the feeders would be prohibitive or the loss in pressure excessive, the alternating current method of transmission is employed. An alternating current of high potential is produced at the power plant and transmitted to sub-stations scattered along the line. In these sub-stations the alternating current is converted into direct current of 500 to 600 volts pressure and distributed to the trolley wire in the manner already described. (A diagram of such a transmission is shown in Fig. 7.) The higher the pressure of the alternating current, the smaller may be made the cross-section of the transmission wire. The usual voltage is from 10,000 to 20,000 volts, although pressures much higher than this have been used. A three-phase alternating current requiring three transmission wires is the common practice. The alternating current method of transmission has been used to some extent on city street railways, but it only shows economy over direct current transmission where the traffic is very heavy and the distance very great, and consequently its use is limited to the very largest cities.

Rolling Stock.— The type and size of the car varies largely with the locality and the kind of service given by the line. The electric car may be divided into three parts, the truck, the

Digitized by Google

body, and the electrical equipment. The truck consists of the wheels, axles and the steel framing which ties them together. It is built entirely independent of the body which rests on it. A car which has one truck under it is known as a single truck car, and one which has two independent swiveling trucks is called a double truck car. Car bodies up to a length of 20 feet usually have single trucks and when of a greater length, double trucks. The ordinary wheel in use on city roads is 33 inches in diameter, and on suburban roads, 36 inches.

The car body may be open or closed, and in some instances the bodies are changed on the same trucks, according to the season of the year. A recent type of car, called the convertible or semi-convertible, which may be converted quickly from open to closed and *vice versa*, has proven very popular. The seats may be cross or longitudinal, or a combination of both. The longitudinal seated car has the greater carrying capacity but the cross-seat is the more attractive to passengers. (Figures 8, 9 and 10 show various types of American cars.)

The electrical equipment consists of the motors, the controllers, and the wiring and regulating devices connected with the power circuit, one or more car-lighting circuits, and a heating circuit. On single truck cars it is customary to install two motors, and on double truck cars either two or four motors. These motors vary in capacity from 25 horse-power each on small cars to 125 horse-power each on heavy suburban cars. They are series wound and are regulated in speed by interposing iron resistances in the main circuit and by working the motors either in series or multiple. There are two controllers for governing the speed, one on each platform. A safety device either in the form of a fuse or automatic circuit breaker, or both, is interposed in the main circuit and a lightning arrester is also installed on all cars using grounded circuits. This much of the electrical equipment is common to cars used on all systems, the current-carrying device varying with each system. Thus with the overhead system a trolley pole and wheel are used, with the third rail system a sliding shoe, with the underground conduit system a plow with two sliding shoes, etc.

For heavy railroad work where it is desirable to run trains of two or more motor cars, a system called the "Multiple Unit System" has been devised. Each motor car is supplied with its own controlling mechanism, and the various sets of controlling mechanisms are operated in unison from a master controller on the platform of any motor car. Thus, one motorman may operate any number of motor cars coupled together and the train may be readily split up into several trains, each section with its own motive power and controlling devices.

For car lighting one or more circuits of 100 or 110 volt incandescent lamps, five in series, are used. On interurban cars an arc lamp is sometimes used as a headlight.

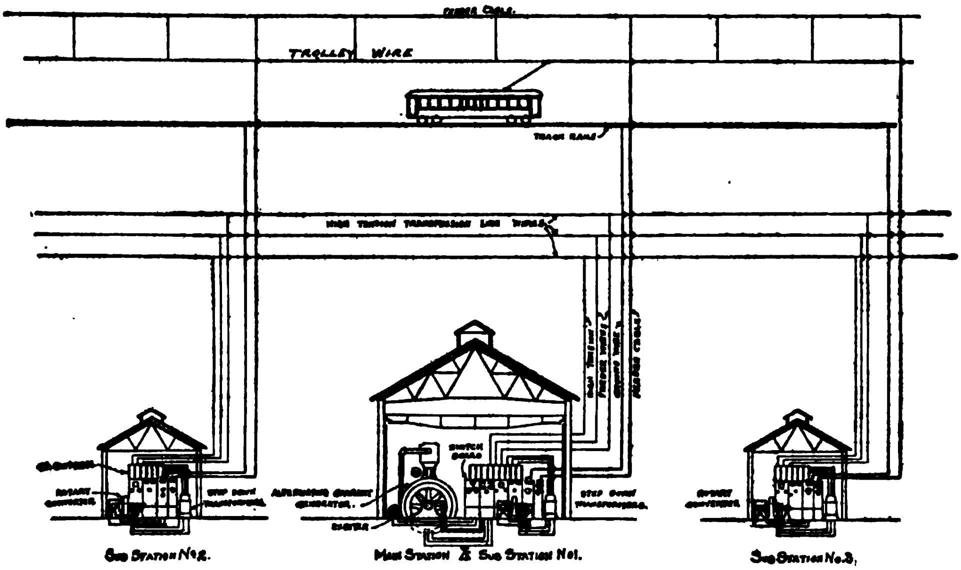


FIG. 7.— Diagram showing three-phase distribution with sub-stations for electric railways.

The car heating is done by stoves burning hard coal, or by hot water or electric heaters. The electric heaters consist of coils of high resistance wire placed beneath the seats. The amount of current required for heating a car is 10 to 25 amperes according to the size of the car and the outside temperature.

The usual method of stopping cars is by pressing cast iron shoes against the rim of the car wheels. Various methods of applying this pressure are in use. The old method and the method in use on small cars is a hand brake on the front platform which acts on the brake shoes through a multiplying set of levers. For heavy cars running at high speed the hand brake is usually supplemented by a power brake of some kind. The momentum of the car is sometimes used to produce the braking power by causing the axle of the car to wind up the brake chain. Electricity either derived from the trolley wire or from the motors used as generators may be used to stop the car. The power brake

Digitized by Google

most frequently used is the air brake. Compressed air is either furnished by a small motor-driven compressor carried on the car, or is supplied from a charging station located on the line, in which case the air is carried in storage tanks on the car. The air is at a pressure of 60 to 80 pounds per square inch, and is applied by a small valve worked by the motorman.

Power Plants.— It would be outside of the scope of this article to enter into a discussion of the power plant. By far the greater proportion of power plants are steam driven, although where reliable water power may be obtained street railway plants are often driven by this means. The same rules apply to the construction of a generating plant for street railway purposes as to the construction of any other important plant. It should be reliable, economical, and not subject to derangements. The present practice is toward the construction of fireproof buildings containing the most approved machinery, and toward the use of machinery wherever possible to do away with manual labor.

Buildings.— The buildings required by a street railway system are offices, power plants, repair shops, and car houses. The extent of these buildings depends entirely upon the size and character of the road. The car houses should be fitted with appliances for overhauling the trucks and electrical equipments, and the repair shops should contain the necessary tools for making and repairing the car parts. The extent of the equipment evidently depends upon the size of the road. On small roads it is customary to combine the car house and repair shop under one roof.

RICHARD M'CULLOCH,
Assistant Manager Chicago City Railway Company.

Street Railways, American. See AMERICAN STREET RAILWAYS.

Streight's Raid from Tuscumbia, Alabama. In the spring of 1863 Gen. Rosecrans organized an expedition to cut the communications of Gen. Bragg's army, then at Tullahoma, Tenn. The objective point was the railroad south of Dalton in northwestern Georgia. For this purpose Col. A. D. Streight, 51st Indiana, who had suggested the expedition, was designated to lead it, and was given a provisional infantry brigade of 1,700 men, composed of the 51st and 73d Indiana, 80th Illinois, 3d Ohio, and two companies of Tennessee cavalry. He was ordered to Nashville to organize the expedition. His instructions were to descend the Cumberland River to Palmyra, thence to Fort Henry, on the Tennessee, and sweep around the rear of Bragg's army, cut all his railroad communications in northern Georgia, destroying manufactories and depots of supplies, and in every way to cripple the Confederates. Having obtained a partial outfit of unserviceable mules, depending upon the country for a further supply, Streight left Nashville 11 April, with his troops on steamboats, and landed at Palmyra, from which point he marched across to Fort Henry, gathering on the way as many serviceable mules as possible. He remained at Fort Henry until the fleet of steamboats went down the Ohio and up the Tennessee to that point, when he again embarked his men on the 17th, and landed at Eastport on the 20th of April. On the 21st, with Gen. Dodge, who with 7,000 cavalry and infantry had marched by way of Corinth and Iuka, to protect the movement, he moved on Tuscumbia to mask his real intention. Following Dodge, who steadily pushed back Roddey's cavalry, he arrived at Tuscumbia on the 24th, and being supplied by Dodge with some animals and rations, and leaving his sick and disabled men with Dodge, who was to return to Corinth, after holding the enemy until Streight could get a good start, at midnight of 26th April, with only 300 of his 1,500 men on foot, Streight cut loose from Dodge, started southward in a heavy storm, and scouring the country for horses and mules arrived at Moulton, after some slight skirmishing, about dark of the 28th. At midnight, every man being mounted, he resumed the march eastward to Day's Gap, about 35 miles, bivouacking on the night of the 29th at the east foot of the gap. March was resumed before daylight next morning, and before his rear-guard had cleared the gap Forrest's cavalry was upon it. With 1,200 men and eight guns Forrest had left Courtland, Ala., 16 miles north of Moulton, at the same hour Streight had left Moulton, and with scarcely a halt had overtaken him. Streight formed an ambuscade, into which Forrest rode and was repulsed with the loss of two of his guns. This check, with Forrest's necessity for rest, gave Streight an advantage of time, which he improved, and in the forenoon of 1 May he reached Blountsville, after a running fight in which he was hard pressed and some of his men captured. Here Streight seized fresh animals, discarded wornout ones, distributed ammunition and rations, burned his wagons, and near noon started for Rome, Ga., the seat of extensive iron works, which he thought to destroy. His column was not fairly in motion before his rear-guard was attacked in the streets of the town. There was a running fight from Blountsville to the Black Warrior River, and upon reaching the river Streight was compelled to make a stand. Forrest was beaten off, and at 5 P.M. Streight crossed the river and moved on with but little more interruption, until 9 A.M. of the 2d, when his rear-guard was fiercely attacked at the crossing of Black Creek, near Gadsden. Forrest was held in check some time by the burning of the bridge, and Streight continued the march to Gadsden, where he made a short halt to rest his men and animals. Continuing the march at 4 P.M., he again halted 15 miles beyond Gadsden to procure forage for his animals. Meanwhile Forrest was pressing him closely, drove in his rear-guard, and made a general attack, in which he was repulsed and fell back, and as it was growing dark Streight withdrew half a mile; but Forrest moving to flank him, he again resumed his retreat intending to reach Rome and burn the bridge over the Chattooga. When, near Cedar Bluffs, Ala., he was again overtaken and attacked by Forrest, he found the bridge over the Chattooga held by the enemy; his men and horses had broken down; he had no hope of accomplishing the principal object of his expedition; and at noon 3 May he surrendered 1,365 men. He had lost in killed, wounded, and captured prior to the surrender 145 men. The captives were sent to Richmond and confined in Libby prison, from

Digitized by Google

which Streight escaped in February 1864 by burrowing under the foundation walls.

Consult: 'Official Records,' Vol. XXIII.; Wyeth, 'Life of Gen. N. B. Forrest.'

E. A. Carman.

Strelitz, strä'lĭts, the life-guards of the Russian czars until the reign of Peter the Great. They were instituted in the latter half of the 16th century by Ivan Vasilievich, and formed also the standing infantry of the empire, amounting sometimes to 40,000 men. Their numerous privileges and their frequent insurrections rendered them as formidable as the Roman prætorians or the Turkish janizaries. Peter the Great dissolved the corps in 1697 in consequence of an insurrection, put several thousand to death, and banished the rest to Astrakhan. Having been guilty of some disturbances here they were entirely dispersed and destroyed in 1705.

Strelit'zia, a genus of perennial herbs of the order *Scitaminaceæ*. The species, of which there are less than half a dozen, are natives of South Africa, and are called bird of paradise flowers. They have stout rhizomes, more or less woody usually short stems, long petioled, generally large paddle-like leaves, and showy flowers of striking form. The genus is closely related to *Musa* (banana, plantain, etc.), *Ravenala* (travelers' tree of Madagascar), *Maranta, Curcuma*, and *Canna* (some of which furnish starch and arrowroot). The best known species (*S. reginæ*) grows about three feet tall, and has a spathe about six inches long, purplish at its base, and surrounding the bases of about six orange and bluish-purple flowers.

Strength of Materials, in engineering, the resistance offered by structural materials, such as iron, wood, and cement, to the action of various kinds of externally impressed forces. Every body, however strong and rigid it may be, yields, to some extent, when an external force is applied to it. In the terminology introduced by Rankine (and since followed by nearly all writers), any force that is applied to a body is called a "stress," and the corresponding deformation that the body experiences, by reason of the applicatior of the stress, is called a "strain." When a stress of any proposed type (for example, a tension or a torsion) is applied to a given body, the strain that is produced is proportional to the stress, so long as the stress does not exceed a certain intensity, whose value depends upon the nature of the material of which the body is composed. This law of the proportionality of strain and stress is known as "Hooke's law," because it was first stated by Robert Hooke, for the special case in which the applied stress is a simple tension. The kinds of stress that are of most frequent occurrence in engineering practice are (1) simple tension, in which the material is subjected to a straight pull, which tends to separate the particles of the body in a direction parallel to the line in which the tension acts; (2) simple compression (or negative tension), which tends to urge the particles of the body nearer together, along lines that are parallel to the line in which the compressive force acts; (3) simple torsion, which tends to cause one part of the body to rotate, relatively to some other part, about an axis which is called the "axis of torsion"; (4) simple shear, in which one part of the body tends to *slide* relatively to some other part. Compound stresses are not infrequently met with in practice, in which two or more of these simple stresses act simultaneously. The crank of a steam-engine, for example, is subject to tension, compression, torsion, and shear. In such cases it is usual to consider the compound stresses as resolvable into two or more simple stresses of different types. It often happens, too, that in a compound stress some one component is so predominant that the others may be safely neglected. In the shell of a horizontal tubular boiler, for example, there is a circumferential tension, and a longitudinal tension; but since the circumferential tension is twice as intense as the longitudinal one, it is customary to omit the latter altogether, in calculating the strength of the boiler. In the case of a crystalline body of the most general kind, the problem of strength is much more complicated than it is in the case of the substances which are employed in ordinary engineering, and which (with the exception of wood) may be regarded as homogeneous and isotropic. (See Crystal; Elasticity.) There are few cases in which we have sufficient data for a proper discussion of the strengths of crystalline bodies; and it is fortunate that such bodies are not used to any great extent in constructive engineering.

The resistances that bodies oppose to forces that tend to rupture them by tension, compression, torsion, and shear, are investigated, in practice, by the aid of "testing machines," in which samples of the material whose strength is to be determined can be subjected to stresses of any given type, great enough to cause rupture. Small testing machines are to be found in all engineering laboratories, and large ones, capable of exerting stresses of great intensity, are maintained by manufacturers of steel and other constructive materials, and by the various governments. The United States Government, for example, has a testing machine in the arsenal at Watertown, Mass., which is capable of exerting a measured tension of 450 tons, and which is probably the largest and most accurate testing machine in the world. It is capable of testing specimens in tension up to 28 feet in length and 30 inches in width; and in compression tests it can handle columns 30 feet long. It was designed by A. H. Emery, and built by Sellers & Company. Upon its completion (in 1879) it was tested, previous to acceptance, in the following manner: A link of hard iron, five inches in diameter, was placed in the machine, and slowly tested by tension until it was broken; the maximum stress upon it, shortly before its destruction, being 722,000 pounds. Without any re-adjustment, a horse-hair was then placed in the machine, and broken at an indicated tensile stress of one pound. There is probably no other testing machine in existence which would have permitted the observation of so great a range of stress.

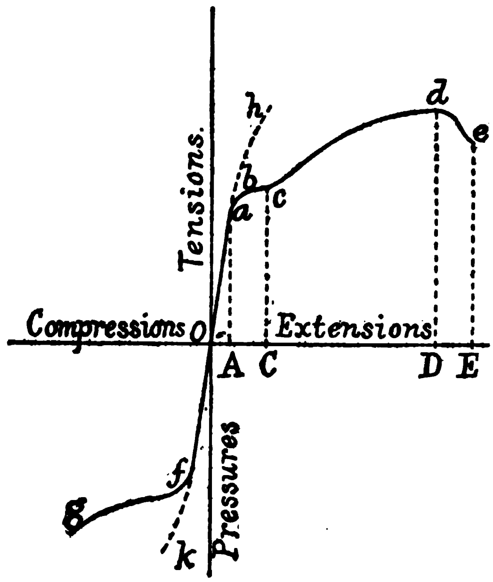
In making a test of a given material, it is important, first of all, that the specimens tested should fairly and accurately represent the material whose strength it is desired to ascertain; and to ensure that this condition shall be fulfilled, it is customary to select the specimens for testing, with the greatest care. When the material is to be used in the manufacture of individually unimportant articles, such as rivets or bolts, it is best to make a random selection of a certain number of the finished articles, and submit these to the test. When the articles to be

Digitized by Google

manufactured are large and individually valuable (as in the case of large forgings or castings), it is customary to design the article so that some part of it can be cut away without harm, for examination in the testing machine. Boiler plate, for example, is tested by examining coupons cut from the various plates in such a manner as to represent, in all probability, the general average character of the material of which the plates are composed, without damaging the commercial value of the plates themselves.

The apparent strength of a given material varies to a considerable extent with the form of the test piece that is examined; and for this reason a great deal of attention has been expended, by engineers, upon the selection of a form which shall be most likely to represent the strength of the material as it exists in the finished article. In some cases the choice of form is limited by the size and nature of the piece to be tested; but when no such limitation is imposed, it is usual, in tension tests, to turn the test specimen down, in its central part, so that it is cylindrical in form at the middle, the diameter of the cylindrical section being something like one inch, and the length from five to eight inches. The ends of the specimen may also be turned to a cylindrical form, so that they may be easily grasped by the jaws of the testing machine; but the ends should always be left considerably larger than the central cylindrical part, so that the piece may break in the central part, and not in the jaws of the machine, nor too close to them. In testing metal plates, the specimens are not turned, but they are cut into the form of strips, which are narrowed down, along the middle portion, to a width of perhaps one inch and for a length of perhaps eight inches; the ends being left wider, so that the fracture will occur in the central part. The central cylindrical (or parallel) part of the specimen should always be caused to merge into the larger ends by means of fillets having a radius of half an inch or so.

When a test piece such as has been described is placed in a testing machine and the tension upon it is gradually increased up to the point of destruction, the observed phenomena vary somewhat, according to the nature of the material under examination. In the case of wrought iron or mild steel, they are as follows: The test specimen begins to stretch, from the moment that it is submitted to tension; the stretch being small, but distinctly visible and measureable, by the aid of a pair of microscopes focused upon fine lines drawn at the two ends of the central part of the specimen. The relation of the stretch to the applied pull is best understood by reference to upper right-hand part of the accompanying diagram, which is called the "stress-strain diagram," since it exhibits the relation of the applied stresses to the strains to which these stresses give rise. In preparing such a diagram, the extension of the test piece is observed and recorded at frequent intervals as the test proceeds, the tension to which the piece is subjected being noted simultaneously. Each such observation is then recorded, graphically, by laying off, from the point O toward the right, a distance which shall represent, on some convenient scale, the observed extension, and then drawing through the point so determined a vertical line, upon which the corresponding observed tension is laid off according to some other convenient scale. For example, if we had observed that the specimen had stretched by 0.0051 inch when the load became 35,000 pounds, we should record this fact by laying off OC to represent 0.0051 of an inch, and then drawing Cc to represent 35,000 pounds. If this plan is continued from the time the tension is first exerted until the specimen finally breaks, we shall obtain a series of points which will lie along a line something like the heavy, irregularly curved line in the upper right-hand part of the diagram. At the outset, and for some considerable distance in a vertical direction (that is, throughout a considerable range of tension), the representative line is sensibly straight. This means that in this region Hooke's law of the proportionality of strain to stress is fulfilled with considerable precision, the extension being proportional to the tension that produces it. Over this part of the diagram the material is said to be "perfectly elastic"; for if the tension is removed, the specimen will contract again to its original



dimensions. As the applied tension becomes greater, however, a point, a, is presently reached, at which it can be perceived that the representative line is no longer straight. The position of this point is usually somewhat uncertain, since the exact point of transition from the straight part of the line to the curved part is hard to determine with precision. The stress to which the test piece is subjected at the point a is properly called the "elastic limit" of the material, or the "limit of proportionality" (that is, the limit at which the strict proportionality of stress and strain ceases). As the test proceeds, the representative line soon becomes markedly curved; and after the curved part has been reached the specimen will not return to its original length if the applied stress is entirely removed. It will indeed shorten upon the removal of the stress, but it always retains a part of its elongation, this permanent part being called the "plastic yield," "permanent set," or "permanent strain," due to the load to which the piece has been subjected. Very shortly after the "limit of proportionality" has been passed, the material

Digitized by Google

begins to take a permanent set that is quite marked, the representative line on the diagram then becoming more distinctly curved. In steel and iron that have been rolled or hammered, there is often (but not invariably) a second point, *b*, on the representative line, at which the material begins to take a considerable strain, without any material increase in the stress. The state of the material corresponding to this point *b* is commonly called the «elastic limit» of the material; but it is more accurate to reserve this name for the state corresponding to the point *a*, the point *b* being more correctly designated as the «yield point.» When the point *b* exists, it is usually so well marked that its position can be determined very well, even with rough instruments. With further continuance of the test, the representative line soon reaches a point *c*, at which the material ceases to stretch without a corresponding increase in the stress, and thereafter the extension of the specimen is accompanied for quite a time by an increase in the stress. The increase of stress per unit of increase in extension falls off, however, until a point *d* is reached, at which the stress has its greatest value. After the point *d* is passed, the material stretches so freely that it is impossible to exert upon it a tension as great as that represented at *d*; and the test piece presently breaks. It should be understood that all of the peculiarities that are represented in this diagram are not invariably observed, even in testing wrought iron and mild steel; and when other materials are examined, the stress-strain diagram often departs from that here shown in a marked manner. The stresses to which a test specimen is subjected are always reckoned per unit of area in the cross section of the original piece. As the diameter of the test piece is reduced by the extension of the piece under test, the load upon the specimen, as computed per square inch of the reduced sectional area, is of course much greater than that computed upon the sectional area of the unstretched specimen; and in fact the tension, as computed upon the basis of the actual area of cross section, goes on increasing up to the end of the test. The maximum stress that the test piece can sustain (as reckoned per square inch of the original section), and which is represented in the diagram by the line *Dd*, is called the «ultimate tensile strength» of the material. The «percentage of elongation» of the specimen is the quotient obtained by dividing the total stretch of the specimen, as observed by microscopic measurements upon two marks upon the test piece, by the original distance between those marks. The sectional area of the test piece (owing to the elongation produced by the tension) is smaller at the point of fracture than in the original specimen. The total diminution of the sectional area at the point of fracture, divided by the original sectional area of the specimen, is called the «contraction of area» of the material.

In testing the compressive strength of materials, care must be taken to have the test piece so short that it will not fail by bending or «buckling.» For compression tests of metals, Thurston recommends that the test pieces be made in the form of cylinders, one inch long and half an inch in diameter. When large testing machines are available, the specimens may, of course, be made larger. For stone and brick, he recommends that the test piece be made in the form of a cube, with edges about two inches each way.

When a short cylinder of wrought iron or of steel is tested to destruction by compression, the stress-strain diagram that is obtained is something like that shown in the lower left-hand part of the diagram. The yield point, *f*, is not usually so well marked as it is in the case of tension. Along the line *Of* the compression that the specimen experiences is proportional to the pressure that is exerted; and if the pressure is removed before the point *f* is attained, the specimen returns to its original dimensions. When the pressure exceeds its value at *f*, the specimen begins to take a permanent set, and the course of the representative line is somewhat as indicated at *fg*. Some materials fracture under a crushing load, but others (such as lead and copper) pass into a semi-fluid state when the pressure reaches a certain intensity, and yield continuously thereafter as the pressure increases, the stress-strain line taking on the form of an approximate hyperbola, with its curvature disposed somewhat as shown in the diagram in the vicinity of *g*. A material, like cast iron, which actually fractures under compressive stress, commonly fails either along a plane that is oblique to the direction of the compression, or else by splitting up into a number of wedge-shaped fragments, each of which is bounded by such oblique planes. The stress-strain diagram of cast iron, in fact, is quite different from that of wrought iron and mild steel. The yield points, both in tension and in compression, are less clearly defined, and there is but little plastic change in the length of the test piece. The general course of the stress-strain line for cast iron is somewhat as indicated by the line *kfOak*, in the diagram.

A shearing stress is a stress which tends to cause one part of a body to slide, relatively to another part. (See ELASTICITY.) Its nature may be illustrated by considering two boards, laid one upon the other. If equal and opposite forces be exerted upon the two boards in the direction of their lengths, one of them will slide upon the other (assuming that the applied forces are great enough to overcome the friction). If the two boards are glued together in this position, however, and are then subjected to the same forces as before, they will not slide. Each will exert a certain force (or stress) upon the other one, however; and this stress, which acts parallel to the surface along which the boards tend to separate, is called a «tangential stress,» or a «shearing stress.» A stress of this kind is produced in a sheet of metal (or other material) that is cut by a pair of shears; and the name «shear» probably refers to this fact. Bolts, rivets, and screws are familiar examples of structural elements that are often exposed to shearing stresses. When two plates of steel are lapped over each other at the edges, for example, and are then united by rivets, any attempt to tear the plates asunder by the agency of forces acting in the planes of the plates will throw a shearing stress upon the rivets. Tensile strengths are expressed (in the United States and in England) by stating the maximum number of pounds (or tons) that the material can withstand without fracture, per square inch of sectional area as measured perpendicularly to the direction in which the ten-

Digitized by Google

sion acts. Compressive strengths are expressed in a similar manner, for materials which actually do fracture under compressive stresses; the compressive strengths of such substances as lead, which flow freely under compression, are indefinite, and are best stated by giving the intensity of the stress (reckoned per square inch, as before), under which the condition of semi-fluidity is first distinctly attained. Shearing strengths are expressed by giving the maximum number of pounds (or tons) that the material can withstand without fracture, per square inch of the area that must be sheared across, in order to produce failure.

The ultimate strengths of materials vary considerably with different specimens, and sometimes within wide limits. In engineering work it is important, therefore, that the actual material that is to be used should be carefully tested, in order that the engineer may know precisely what strength he can safely assume his materials to withstand. The strengths of different kinds of materials can be stated in a general way, however, if it is clearly understood that the data that are given are only approximate, and that actual tests are to be used in every important case, when such tests are available.

oak is about 8,000 pounds per square inch, and that of the other woods mentioned range from 5,000 to 6,000 pounds. The compressive strength of ordinary mortar is from 150 to 300 pounds per square inch, when the mortar has thoroughly set. Portland cement is far stronger, and when thoroughly set it has a tensile strength of about 700 pounds per square inch.

In designing a structure it is essential that the load on every part of it shall be much less than the ultimate strength of the material of which that part is composed. In practice it is therefore customary to divide the ultimate strength of the material by a certain numerical factor, called the "factor of safety," and to use the quotient as the load that the material can safely withstand in the actual structure. Merriman's factors of safety for work of various kinds are given in Table II.

In the construction of steam boilers, the shell, tubes, and other parts that are constructed of wrought materials, should have a factor of safety of 5; and the factor of safety of such cast-iron parts as may occur should be at least 20.

Torsional stresses are largely of the nature of shearing stresses, but they are less simple,

TABLE I.— STRENGTHS OF MATERIALS, IN POUNDS PER SQUARE INCH.
(According to Unwin.)

Material		Tensile strength		Crushing strength		Shearing strength	
		Ultimate	Elastic	Ultimate	Elastic	Ultimate	Elastic
Cast iron	from	30,500	Indefinite	130,000	Indefinite	12,000	Indefinite
	to	10,800	Indefinite	50,000	Indefinite	8,700	Indefinite
Wrought iron bars	from	67,000	30,000	50,000	30,000	49,000	22,000
	to	33,500	(average)	(average)	(average)	22,400	(average)
Steel plates	from	65,000	42,000	......	38,000	50,000	......
	to	110,000	67,000	......	71,000	83,000	......
Steel boiler plates		66,000	36,000	......	......	56,000	......
Rivet steel		65,000	46,000	......	......	55,600	......
Copper, rolled plates		31,000	5,600	......	4,000	......	3,000
Copper, annealed wire		45,000	......	......	......	......	......
Brass	from	17,500	......	......	......	......	......
	to	29,000	......	......	......	......	......
Cast zinc		7,500	3,200	......	......	......	......

In Table I. we present certain of the average values that are given by Unwin in his tables of the strengths of materials, as representing ordinary practice. The values that he gives for steel boiler plates are somewhat larger than are used in the United States, where a tensile strength of from 55,000 to 65,000 pounds per square inch is the general rule. Stronger boiler plates can easily be made, but they are believed to be apt to be deficient in ductility. Ordinary structural steel has a tensile strength of from 60,000 to 70,000 pounds per square inch, and an elastic limit (in tension) of about half that amount. Steel, alloyed with a small quantity of nickel ("nickel-steel"), may have an ultimate tensile strength of 275,000 pounds per square inch, and an elastic limit (in tension) of 100,000 pounds per square inch; and on account of these properties, it is continually growing in favor for uses in which great strength is required, and the expense of the alloy is not prohibitive. Wood, when exposed to tension, shows only a very slight elongation. The tensile strengths of hemlock, red oak, and white pine are approximately equal, being each about 8,000 pounds per square inch. White oak and chestnut have a tensile strength of about 12,000 pounds per square inch The compressive strength of white

TABLE II.— FACTORS OF SAFETY.

Material	For steady loads (buildings)	For varying loads (bridges)	For shocks (as in machinery)
Wood	8	10	15
Stone and brick	15	25	35
Wrought iron	4	6	10
Cast iron	6	15	20
Steel	5	7	15

because the forces that are exerted upon the material are not parallel, especially when the material yields to their action to some extent. For an adequate discussion of stresses of this kind, the more extended works on machine design and the strength of materials should be consulted. (See the bibliography at the end of this article.) Reference should also be made to these works for the formulæ that are used in the design of such structural units as beams and long columns.

In the foregoing account of the phenomena exhibited by a test piece when that piece is pulled apart in a testing machine, or when it is similarly compressed to destruction, it is assumed that the stress is applied in a uniformly

Digitized by Google

increasing manner, until the specimen fails. The effects that are to be observed when a given kind of material is exposed to intermittent, varying, or alternating loads have been studied by many observers; but the phenomena are complicated, and the results that have been thus far obtained cannot be considered to be absolutely final. Wöhler's name is especially associated with experiments of this kind, since he was the first to perform them in an exhaustive manner. It is found that the safety of a structure that is subjected to a variable load does not depend solely upon whether or not the load is always within the strength corresponding to the "yield point" of the material, but that the *range of variation* of the load must also be considered. The fact has been established that a given material may break under the influence of a large number of repetitions of a load that does not at any time come up to the original elastic limit of the material; and this fact has been commonly expressed by saying that the material becomes "fatigued." This term is objectionable, because it has been used in several senses, and is therefore somewhat indefinite. The investigations of Wöhler and others along these lines have led to the practice of rejecting railway car axles after they have made a certain number of revolutions in service, even although they appear to be perfectly sound and safe; but in many other branches of engineering no attempt has yet been made to incorporate the results of such experiments in the data that are in practical use. The difficulties of the subject will be understood from the following quotation from Unwin: "It would appear likely that any gradually progressive alteration or fatigue of the bar would be manifested in some way in alteration of the strength, the elastic limit, or the elongation of the bar when tested in the ordinary way. But this appears not to be the case. A bar subjected to so many repetitions of loading that it is known to be on the point of breaking, or a piece of a bar already broken in an endurance test, gives in the testing machine no indication that the strength or ductility have been altered."

Consult: Trautwine, 'Engineer's Pocket Book'; Kent, 'Mechanical Engineer's Pocket Book'; Merriman, 'Strength of Materials'; Thurston, 'Materials of Engineering'; Unwin, 'Elements of Machine Design,' 'The Testing of Materials of Construction'; 'Proceedings of the American Society for Testing Materials'; Rankine, 'Applied Mechanics,' 'Rules and Tables'; Grashof, 'Festigkeitslehre'; War Department of the United States, 'Reports of the Tests of Metals and Other Materials,' made with the great Watertown testing machine.

A. D. Risteen, Ph.D.,
Editorial Staff, 'Encyclopedia Americana.'

Strenuous Life, The, a collection of 13 essays and addresses on various subjects by Theodore Roosevelt, published in 1900. The book takes its title from the first of the series.

Streptococ'cus. See Coccus.

Stretford, strĕt'fōrd, England, a town in Lancashire four miles southwest of Manchester. Among its chief features are a public hall, municipal offices, a free library, charitable institutions, and botanical gardens. It has numerous cotton factories.

Stretton, strĕt'ŏn, **Hesba,** the pseudonym of Hannah Smith, English novelist: b. Wellington, Shropshire. She began writing fiction in 1859, and among her 40 or more books may be mentioned 'Bedés' Charity' by which she is best known; 'The Doctor's Dilemma'; 'Hester Morley's Promise'; 'Soul of Honor.' Her works are deservedly popular and have been translated into all of the European and several of the Asiatic languages.

Strickland, strĭk'land, **Agnes,** English historical writer: b. Reydon Hall, Suffolk, 19 Aug. 1806; d. there 8 July 1874. She was one of five sisters, all of whom were writers. Her first work, in which she was aided by her sister Susannah, was a volume of 'Patriotic Songs,' followed by 'Worcester Field,' a historical poem. Her later works were 'Queen Victoria from her Birth to her Bridal' (1840); 'Historic Scenes and Poetic Fancies' (1850); 'Lives of the Bachelor Kings of England' (1861); 'Lives of the Seven Bishops' (1866); 'Lives of the Tudor Princesses' (1868). Her best works are 'Lives of the Queens of England' (12 vols., 1840–8), and 'Lives of the Queens of Scotland' (8 vols., 1850–9). In these her sister Elizabeth collaborated, but at the latter's own desire her name was not revealed as co-author with Agnes. Miss Strickland's work is very readable and has been exceedingly popular, but belongs to a school of historical writing now gone by. Consult 'Life' by her sister Jane (1887).

Strict Constructionists, in American politics, those who believe the Federal government has no rights nor powers which are not expressly granted by the Constitution. The Anti-Federalists (q.v.) were strict constructionists.

Strict Observance, Friars of. See Orders, Religious.

Stricture, a morbid contraction of a mucous canal or duct of the body, as the urethra, œsophagus, or intestine, etc. When, however, the affected part is not mentioned, and a person is stated to suffer from stricture, it is always the urethral canal that is referred to. Contraction of this canal may be either permanent or transitory. The first form is due to a thickening of the walls of the urethra in consequence of organic deposits, and is hence termed organic stricture; the second may be due either to local inflammation or congestion, or to abnormal muscular action, the first of these varieties being inflammatory or congestive stricture, and the second spasmodic stricture, of which the last named seldom exists except as a complication of the other kinds of stricture. There are two principal causes of organic stricture — the first being inflammation of the canal, and the second injury by violence. Inflammation is by far the most common cause, and gonorrhœa is the common agent by which it is excited. It is only in exceptional cases that a stricture results from inflammation of the urethra. Stricture from the second cause arises from such causes as falling across spars, scaffolding, ladders, etc., or from some sharp object which punctures the perinæum.

The earlier symptoms of stricture are a slight urethral discharge and pain in the canal behind the seat of the stricture at the time of micturition. The stream of urine does not pass in its ordinary form, but is flattened or twisted, and

Digitized by Google

as the disease advances it becomes smaller, and ultimately the fluid may only be discharged in drops. The straining efforts to discharge the urine often induce tenesmus. As the case advances the urine becomes alkaline and ropy, and deposits a precipitate when allowed to stand; and attacks of complete retention of urine occur with increasing frequency. But these symptoms are not in themselves sufficient to establish the presence of stricture. It is necessary to examine the urethral canal with a catheter or bougie to ascertain whether an organic obstruction exists, whether one or more strictures are present, and their calibre. The treatment of organic stricture is chiefly mechanical. It is sufficient to its object to restore the natural calibre of the canal so far as this can be safely effected, and to maintain this patency after it has been established.

Spasmodic stricture usually occurs as a complication of organic stricture or of inflammation of the mucous membrane, but may arise from an acrid condition of the urine, from the administration of cantharides, turpentine, etc., and from the voluntary retention of urine for too long a time. The treatment consists in the removal of the causes as far as possible and the hot bath. The inhalation of chloroform sometimes gives immediate relief. Inflammatory or congestive stricture commonly arises when a recent purulent discharge from the urethra has been checked by external cold or wet. The treatment is much the same as that for retention of urine.

Stri'ges, the suborder containing the owls, the typical family of which is *Strigidæ*. See Owls.

Strikes and Lockouts. A strike is a cessation of work on the part of workingmen to enforce their demands against the employer or to resist demands and rules made by the employer; a lockout is a cessation of work on the employer's initiative to enforce demands against his employees. Strikes are essentially a feature of the modern industrial organization; they were but little known before the 19th century, and the largest and most important strikes have occurred since 1870. While it is true that strikes have increased as the modern labor union has grown, yet it is also true that many strikes occur in unorganized or poorly organized industries; and it has usually been true that a young organization is much more apt to enter upon strikes as a means of testing its strength and enforcing its demands than an old organization. The older and stronger a labor union grows, as a rule, the more conservative it is in regard to strikes, and the less likely to order a strike for petty and insufficient cause. Nevertheless strikes are a recognized and important part of trade union policy. They are defended by trade unions on the following grounds: they are absolutely the only means which labor has of enforcing its demands in case argument and arbitration fail, and afford the most practical means of controlling the supply of labor for the benefit of labor; whether a strike succeeds or not it attracts public attention to the question at issue, and may lead to the satisfactory solution by the pressure of public opinion; they mark the line beyond which labor will not be forced in the reduction of wages or enforcement of unjust demands; the very possibility of a strike which inflicts an injury which the employer desires to avoid often prevents the attempt to enforce demands which employers know would be unwelcome to labor. The more radical, Socialist view of a strike is based on the Socialist doctrine that the interests of labor and capital are necessarily antagonistic; that a strike, therefore, is an attempt to advance the interests of labor as against those of capital and is from labor's point of view entirely right and justifiable; it is a sort of advance skirmish in the war of interests between labor and capital, and useful as winning some definite advantage to labor, or of proving the strength and vitality of the labor movement and inflicting a more or less serious injury on capital. Against the policy of strikes it is urged that they cause heavy loss to both the labor and capital lying idle; that with their modern magnitude they seriously affect the whole industrial life, and inflict an injury upon the general public; and that the points gained by labor are not commensurate with the cost of the strike. It must be remembered, however, that a strike is essentially a war, and that many of the evils of war attend it; whereas if it be based upon a principle of justice it can be defended upon the same grounds as a war.

Causes of Strikes.— The chief causes of strikes are centred about the wage question; the largest number of strikes in the decade of 1881–1900 were for increase of wages; other important causes are for reduction of hours, against reduction of wages, for the recognition of the union, and for the enforcement of union rules. The following statistics are taken from the report of the Industrial Commission covering the years of 1881-1900:

LEADING CAUSES OF STRIKES.

Cause	Number of Strikes	Per cent of whole number
Increase of wages	33,731	28.70
Increase of wages and reduction of hours	13,201	11.23
Reduction of hours	13,116	11.16
Against reduction of wages	8,423	7.17
Sympathetic	4,078	3.47
For union recognition	1,649	1.40
For enforcement of union rules	1,068	.91
For increase of wages and recognition of union	1,111	.95

Sympathetic Strikes.— The sympathetic strike is one undertaken by a body of workmen who have no special grievance of their own in behalf of another body of workers on strike. It is of recent development and is based upon the workingman's recognition of the principle of the "solidarity of labor"; the principle that labor's interests are everywhere essentially the same, and that an injury to one is an injury to all. The sympathetic strike is usually undertaken by workingmen employed by the same employer as the original strikers; or against an employer in some direct relationship with the employer of the original strikers, as competitor, buyer or seller, or co-operating. In this way their action has direct economic effect on the question at issue, as well as the more general and less tangible effect of "sympathy." Sympathetic strikes involve the dangers of violence, and the weaken-

Digitized by Google

ing of a powerful organization, by the keeping idle of a body of men not so closely bound together nor so individually interested as if the strike directly concerned their personal welfare. Nevertheless, the mere fact that sympathetic strikes are undertaken is a proof of the development to some extent of a more enlightened and far-seeing self-interest, which often amounts to altruism, among workingmen. In connection with sympathetic strikes, the question of the universal strike may be mentioned; a universal strike in all departments of industry to obtain some special demand is naturally the logical development of the sympathetic strike. The universal strike has never been a problem for serious consideration in the United States; but on the Continent, where the labor movement is largely directed by the Socialists, it has been frequently agitated, especially in France; and was used as a powerful weapon in Belgium in 1893 to force the government to the adoption of the principle of universal suffrage.

Methods of Conducting a Strike; Picketing, etc.—The ordinary method of beginning or "ordering" a strike is by vote of those who are concerned; in the case of organized labor, the matter is usually referred to the national officers for an attempt at settlement, or approval of the action of the strikers, the latter securing the support of the whole organization. Often in large strikes, or in the case of partially organized industry appeal for financial aid and moral support is made to labor in general or to some large general organization like the Federation of Labor. The interest of the strikers is kept up, and public interest aroused by meetings, speeches, and the circulation of literature. The most important consideration is to prevent the "breaking" of the strike either by defections from the ranks of the strikers or by the bringing in of more workmen to take their places. The method generally adopted to prevent the latter is known as picketing, that is, the placing of some men near the establishment involved in a strike to speak to any who may come to take the strikers' places, and to dissuade them from so doing. This has led often to threats and intimidation on the part of the pickets; and sometimes to violence. The result has been that the tendency of judicial decisions is to declare picketing illegal, or to so strictly limit the rights of the pickets as to make their work practically useless; a few States have declared picketing illegal by statute. Another method of preventing workmen from taking strikers' places is by large general meetings near the establishment involved, or at the place where workmen are brought into the town; this, however, is a more dangerous method than picketing, as it is often the means of collecting a large and irresponsible crowd, quite beyond the control of the leaders of the strike. Violence in a strike probably works more harm to the strikers than to any other party concerned; it arrays public opinion against them, and brings against them the forces of government, and the military. Trades unionists everywhere recognize this fact, and invariably denounce violence whenever it occurs; the violence is often committed by persons having nothing to do with the strike, but taking the opportunity to do mischief, and when committed by the strikers has not the approval of organized labor. It is often charged that strikers have sometimes been provoked to violence by agents of the employers in order to give better cause for breaking the strike; such charges are difficult to prove, but it is generally the opinion that such cases have occurred in the coal fields at least, if not elsewhere. One of the methods of fighting a strike which has recently come to the fore is the injunction. The first time the injunction was of marked importance was in the Pullman strike of 1894, when the officers of the American Railway Union were enjoined not only from threats, intimidation, and encouraging violence, but also from aiding or "persuading" any persons to strike. Injunctions since then have been frequently used, and are often very severe against the strikers; the terms of most sweeping injunctions, however, have usually been changed in favor of the workingmen if the matter was brought into court by the strikers.

History and Statistics.—The first strike on record in the United States is that of the bakers in New York in 1741; the strikers were brought before the court on a charge of "conspiracy," but not convicted; the shoemakers of Philadelphia struck for increase of wages in 1792, and three times subsequently before 1800; and were in every case successful; in 1805 the shoemakers again on strike were convicted in court on a charge of forming a "combination to raise wages," and were fined eight dollars a head. Up to the Civil War strikes were comparatively few, and small in extent; they were mostly for increase of wages or reduction of hours. After the Civil War the strikes increased in number and in importance; in 1872 occurred a succession of strikes in the building trades for the eight-hour day, which were mostly successful. In 1877 was the great railroad strike, begun by the firemen of the Baltimore & Ohio against a reduction of wages; it spread to the Pennsylvania, the Erie, the Lake Shore, and numerous other important railroads, and involved a large amount of violence and bloodshed, particularly in the region about Pittsburg. Numerous strikes have taken place in the coal fields, and have as a rule been attended with more or less bloodshed; though many have failed, some have been successful, and the miners have gained some important points. Prominent among the coal strikes are those in the bituminous coal fields in 1894 and 1897, the latter resulting in a fairly satisfactory wage scale; and those in the anthracite coal fields of 1900 and 1902, that of 1902 threatening a coal famine and being adjusted by a commission appointed by the President of the United States. Among other noted strikes was that at Homestead in 1892, and the Pullman strike of 1894; the latter was a sympathetic strike undertaken by the American Railway Union in behalf of the employees of the Pullman Company, their purpose being to boycott the Pullman cars and prevent the railroads from hauling them; traffic was seriously delayed, and considerable violence occurred, especially in Chicago; the national troops were brought into use by President Cleveland, though against the protests of the governors of Illinois and other States. The injunction, before mentioned, caused the imprisonment of the president and other officers of the American Railway Union, and the strike was a failure, though for the first days it promised success.

The statistics of strikes for 1881–1900 show that there were 22,793 strikes, involving 117,509

Digitized by Google

establishments, and 6,105,694 workingmen; of this number 50.77 per cent were successful; 13.04 per cent partially so, and 36.19 per cent failed. The greatest per cent of strikes which were successful were for reduction of hours, overtime pay, etc., 59.3 per cent; 53.2 per cent of those for increase of wages were successful, and 18.2 per cent partially so; and 50.8 per cent of those for recognition of the union were successful. The statistics of lockouts show 42.93 per cent successful and 6.28 per cent partially so.

A. M. Burnham, A.B.,
Editorial Staff, 'Encyclopedia Americana.'

Strindberg, strĭnd'bĕrg, **August,** Swedish novelist: b. Stockholm 22 Jan. 1849; d. 14 May 1912. He went to Paris in 1879 remaining there ten years. His first work was a drama 'Master Olof,' followed by 'The Red Room,' 'The Secret of the Club,' 'Mr. Bengt's Wife' (1889); 'The Keys to the Kingdom of Heaven' (1892); 'Utopians in Real Life' (1885) and 'In the Offing' (1891). He was the author of many other novels, dramas and tales and the leading apostle of naturalism in Sweden.

Stringham, strĭng'am, **Silas Horton,** American naval officer: b. Middletown, N. Y., 7 Nov. 1798; d. 1876. He joined the United States navy in 1809, and served on the frigate President. He was promoted lieutenant in December 1814; served on the schooner Spark in the Mediterranean Sea in 1815–18; and took part in the war with Algiers. In 1821–4 he was executive officer on the Hornet in the West Indies, and took part in the capture of the Moscow. He was promoted captain in 1841; he served on the Ohio during the bombardment of Vera Cruz in 1847, and later was made a rear-admiral.

Striped Bass, Skunk, Squirrel, Snake, etc. See Bass, Skunk, Squirrel, Garter Snake.

Stroebel, strē'bl, **Edward Henry,** American diplomat: b. Charleston, S. C., 7 Dec. 1855; d. Bangkok, Siam, 15 Jan. 1908. He was graduated from Harvard in 1877 and from Harvard Law School in 1882, and after practising in New York (1883–5) was secretary of the United States legation at Madrid in 1885–90. He was 3d assistant secretary of state April 1893, April 1904, minister to Ecuador April to December 1894, and to Chile 1894–97, and in 1899 was appointed counsel for Chile before the United States and Chilean Claim Commission. From 1898–1906 he was Bemis professor of international law at Harvard. He was granted leave of absence by the University in 1903 to become general adviser to the Siamese government and in 1906 resigned from the University to become permanent adviser.

Stromboli, strŏm'bō-lē, an island of the Lipari or Æolian group, in the Mediterranean Sea, off the northern coast of Sicily. It consists of a lofty volcano, whose cone rises to a height of 3,022 feet, and is in constant activity. It was believed by the ancients to be the abode of Vulcan, and in Mediæval times, the entrance to purgatory. The island is fertile and its chief products are cotton, wine, figs, and other fruits belonging to this region. It yields besides, sulphur and pumice stone. Some warm mineral springs are found.

Strong, Augustus Hopkins, American theologian: b. Rochester, N. Y., 3 Aug. 1836. He was graduated at Yale in 1857 and was Baptist clergyman at Haverhill, Mass. (1861–5), and Cleveland, Ohio (1865–72). Since 1872 he has been president and professor of Biblical theology at the Rochester Theological Seminary. He has written 'Systematic Theology'; 'Philosophy and Religion,' and 'The Great Poets and Their Theology.'

Strong, Caleb, American statesman: b. Northampton, Mass., 9 Jan. 1745; d. there 7 Nov. 1819. He was graduated at Harvard College in 1764, studied law, and was admitted to the bar in 1772. During the Revolution he was a member of the general court or legislature and of the Northampton committee of safety. For nearly 25 years after 1776 he was county attorney, in 1779 was a member of the state constitutional convention, and in 1780 of the state council, and several times represented his county in the state senate. In 1787 he was elected to the convention for framing a national constitution, but was obliged by sickness in his family to return home before the completion of its labors; and in 1789 he was elected one of the first U. S. senators from Massachusetts, was re-elected in 1793, and resigned in 1796. From 1800 to 1807 he was governor of Massachusetts, and again from 1812 to 1816. As a Federalist he was opposed to the war with England, and his conduct during the war was the subject of severe animadversion by his political opponents.

Strong, Frank, American educator: b. Venice, N. Y. He was graduated at Yale in 1884, and was admitted to the bar in Rochester, N. Y., in 1886. He began the practice of law in Kansas City, Mo., but retired in 1892 to become superintendent of schools at Lincoln, Neb. In 1899 he was made president of the University of Oregon, and in 1902 returned to Kansas, where he was called to the chancellorship of the State University. His published works include: 'The Government of the American People' (1891); 'Life of Benjamin Franklin' (1898); and 'Cromwell's West Indian Expedition' (1899).

Strong, George Crockett, American soldier: b. Stockbridge, Vt., 16 Oct. 1832; d. New York 30 July 1863. He was graduated from the United States Military Academy in 1857 and in the Battle of Bull Run was ordnance officer on General McDowell's staff. In 1862 he was in command of an expedition from Ship Island to Biloxi, Miss., and the next year participated in the operations against Charleston, and in the two attacks on Fort Wagner. In the last he fell mortally wounded. Fort De Kalb on the Potomac was renamed Fort Strong in his honor. Author 'Cadet Life at West Point' (1862).

Strong, Josiah, American clergyman: b. Naperville, Ill., 19 Jan. 1847. He was graduated at Western Reserve College in 1869, and received a theological training at Lane Theological Seminary; was ordained in the Congregational Church, and held pastorates in Wyoming and Ohio; was secretary of the Evangelical Alliance for the United States in 1886–98. In the latter year he was made president of the League for Social Service. His publications include: 'Our Country' (1885); 'The New Era' (1893); 'The Twentieth Century City' (1898); 'Religious Movements for Social Betterment' (1900); and 'Expansion' (1900).

Digitized by Google

Strong, Theodore, American mathematician: b. South Hadley, Mass., 26 July 1790; d. New Brunswick, N. J., 1 Feb. 1869. He was graduated at Yale University in 1812; professor of natural philosophy and mathematics at Hamilton College in 1816–27; and held a similar chair at Rutgers College in 1827–61. In the realm of pure mathematics he was conceded to have no superior. After the ablest mathematicians of Europe had failed to solve the irreducible case of cubic equations left by Cardan, he discovered its solution by a direct method. His publications include 'Notes on the Parallelogram of Forces and on Virtual Velocities' (1864); 'On the Integration of Differential Equations of the First Order and Higher Degrees' (1864); 'A New Theory of the First Principles of the Differential Calculus' (1865); 'A Treatise on Elementary and Higher Algebra' (1869); 'A Treatise on the Differential and Integral Calculus'; etc.

Stron'tianite, native strontium carbonate, a mineral usually found massive with a crudely fibrous and radiating structure. It rarely occurs in perfectly developed, orthorhombic crystals simulating aragonite in form and twinning, spire-shaped, branching groups being the most common. It has good prismatic cleavage; is brittle, breaking with an uneven fracture; hardness 3.5 to 4; specific gravity 3.69; lustre vitreous; color usually yellowish-white, sometimes pale greenish; streak white; transparent to translucent. Before the blowpipe it swells and sprouts, but fuses only on thin edges. It imparts to the flame the crimson color characteristic of strontium. Its name is due to its occurrence in Strontian, Scotland, but its most important locality is Hamm, Westphalia. It is found at Schoharie and elsewhere in New York. Celestite and strontianite are the minerals from which all of the strontium salts so valuable in sugar refining and in pyrotechnics are derived.

Strophan'thus, a genus of trees, shrubs or climbers, belonging to the *Apocynaceæ,* and found in Asia and Africa, being chiefly tropical. The leaves are feather veined and opposite, and the cymose inflorescence is terminal. The flowers are handsome, ranging in color from white, through the yellows and reds, to purple. The calyces are glandular, the corollas funnel-shaped, with five lobes tapering into attenuated, long tails. The two carpeled ovaries develop into capsular fruits having two diverging free follicles, which enclose the hairy seeds. A climbing species (*S. hispidus*) has seeds which are hairy and have a plumose tuft of silky hairs attached to their apexes, by a slender filament and which contain a bitter, poisonous glucoside called strophanthin. This poison contracts the voluntary muscles, and is so deadly that an elephant wounded by the spiked and strophanthus-poisoned beams, which are hung for the purpose in the runs of the huge beasts, is unable, it has been stated, to go more than ten miles from the spot. Species of Strophanthus, especially *S. hispidus,* are powerful ingredients of those African arrow-poisons called in West Africa inée, onaye or poison of Pahonias, and in East Africa, Kombé; while still another near Somaliland is known as wanika poison. Strophanthin is a valuable cardiac stimulant, and a drug employed in heart disease, similar in its effects to digitalis, slowing the heart's action, and increasing its contractility and the tension of the arteries, but is more rapid and uncertain in its effects than the other drug. Several species are known in gardens and greenhouses, one, *S. petersianus,* being remarkable for its octopus-like twisted corolla lobes, colored red and yellow.

Strophe, strō'fē, the name of one of the divisions of a Greek choral ode. The singing of the strophes on the stage was accompanied with a motion or turn from right to left toward the images of the gods placed on the sides of the orchestra (in the ancient sense of this word); but the singing of the antistrophe, with a contrary motion, from the left to the right.

Strossmayer, strŏs'mī-ĕr, **Joseph Georg,** Hungarian bishop: b. Essek, Slavonia, 4 Feb. 1815. He was educated for the priesthood at the University of Budapest and at Vienna, and in 1849 was made bishop of the Croatian diocese of Diakovo. He was for many years the leader of the movement for the separate existence and self-government of Croatia, and was known as a zealous churchman. At the Vatican Council in 1870, he was the leader of the Opportunists, the party which opposed the declaration of the dogma of infallibility on the ground that the times were not rife for the definition. But when the Council declared it to be a formal article of faith, he acquiesced and subscribed to it.

Strother, stroth'ėr, **David Hunter** («Porte Crayon»), American author and artist: b. Martinsburg, Va., 16 Sept. 1816; d. Charleston, W. Va., 8 March 1888. Before the outbreak of the Civil War his articles and illustrations of Southern life attracted wide attention, being especially noteworthy for their faithful presentation of Southern scenes and customs. He served as colonel in the Union army during the Civil War. His writings were collected in book form and published under the names of 'The Blackwater Chronicle' (1853); 'Virginia Illustrated' (1857).

Stroudsburg, strowdz'bėrg, Pa., borough, county-seat of Monroe County; on Broadhead Creek, and on the Delaware, L. & W., and on the New York, S. & W. R.R.'s; about 25 miles north of Easton. It is in the Blue Ridge region, between the Delaware Water Gap and Mount Pocono. The climate, scenery, good water, and the good roads have made the place a favorite summer resort. There are public and private schools, and two national banks with a combined capital of $150,000. Pop. (1890) 2,419; (1900) 3,450; (1910) 4,379.

Strouse, strows, **Myer,** American politician: b. Germany 16 Dec. 1825. He came with his father to the United States in 1832 and settled in Pottsville, Pa. He studied law, and from 1848 to 1852 edited in Philadelphia the 'North American Farmer.' In 1862 he was elected representative in Congress for the 10th District, Pennsylvania, and served two terms.

Strozzi, strŏt'sē, the name of a wealthy and illustrious Florentine family. Palla, Filippo, and Piero were the three most renowned members of this princely house, between 1432 and 1537, and who were either exiled or lost their lives in the struggle for liberty against the power of the Medici family.

Strozzi, Bernardo (Il Prete Genovese, or Il Cappucino), Italian painter: b. Genoa 1581;

Digitized by Google

d. Venice 1644. He painted in the naturalistic style of Caravaggio, and produced many frescoes and easel pictures in oils. They are all of a somewhat crude character, and fiery coloring, though the design is strong.

Structural Shapes. See RAILS AND STRUCTURAL SHAPES.

Structural Steel. See RAILS AND STRUCTURAL SHAPES; STEEL MANUFACTURE.

Struensee, stroo'ĕn-zā, **Johann Friedrich,** Danish statesman: b. Saxony 5 Aug. 1737; d. 28 April 1772. He studied medicine, and in 1768 was appointed physician to the king of Denmark. He soon became a favorite, and effected the dismissal of all those who were obstacles to his own ambitious plans. In 1770 he advised the king to abolish the council of state, a measure which roused the indignation of the Danish nobility. Struensee by various means gradually usurped the administration of all affairs in the name of the king, and caused himself to be created count. His arrogance caused a conspiracy against him, and on 16 Jan. 1772, Struensee was seized, was found guilty of criminal relations with the queen, convicted, and executed.

Strut, in architecture, a brace or support, either upright, horizontal or diagonal. The struts of a roof extend obliquely from a rafter to an upright post. Diagonal struts are frequently used in gates, doors, and between joists.

Struthion'idæ, the ostriches (q.v.) and related ratite birds.

Strutt, strŭt, **Joseph,** English antiquary: b. Chelmsford 27 Oct. 1749; d. London 16 Oct. 1802. He was articled to W. W. Ryland, the engraver, and obtained the gold and silver medals of the Royal Academy. In 1773 he published his 'Regal and Ecclesiastical Antiquities from Edward the Confessor to Henry VIII.,' and shortly afterward his 'Horda Angel-Cynnan, or Manners, Customs, etc., of the English' (1774–6). His other works include a 'Chronicle of England' (1777–8); 'Biographical Dictionary of Engravers' (1785–6); 'Dresses and Habits of the People of England,' etc. (1796–9); and 'Sports and Pastimes of the People of England' (1801). He left some manuscripts, from which were afterward published his 'Queenhoo-Hall,' a romance, concluded by Sir Walter Scott; 'Ancient Times,' a drama; also 'The Test of Guilt, or Traits of Ancient Superstition,' a tale.

Struve, stroo'fĕ, **Friedrich Georg Wilhelm von,** German astronomer: b. Altona 15 April 1793; d. 23 Nov. 1864. In 1813 he entered the Dorpat observatory, and was appointed director in 1817. On the completion of the Russian observatory at Pulkova, near Saint Petersburg, in 1839, he was nominated its director, and here he continued his researches on nebulæ and double stars. From 1816 to 1819 he was engaged on the triangulation of Livonia, and from 1830 to 1845 he was connected with the measurement of the arc of the meridian in the Baltic provinces, which was afterward extended to the Arctic Ocean and the Danube.

Struve, Otto Wilhelm, Russian astronomer: b. 7 May 1819. He early studied at the Dorpat and Pulkova Observatories, and on the death of his father succeeded him as director of the great Pulkova Observatory near Saint Petersburg. His work was given mostly to the observation of double stars, and to continuing the organization and administration of the great observatory founded by his father. He was the presiding officer of the International Astrophotographic Congress at Paris in 1877. In 1890 he resigned the directorship at Pulkova.

Strychnine, strĭk'nĭn, $C_{21}H_{22}N_2O_2$, an alkaloid existing in the seeds of the Strychnos Nux-vomica, Saint Ignatius bean, and the other species of Strychnos. The Strychnos Nux-vomica is a tree of medium size growing in the East Indies. It bears a pulpy fruit about the size of an orange, containing the large seeds that are the drug nux-vomica. These seeds are circular, about three quarters of an inch in diameter, an eighth of an inch thick, and very hard and horny. Rasped or filed they are used to kill cats, dogs, rats and vermin under the name of rats-bane or dog buttons. The active principle strychnine may be obtained by treating nux-vomica with alcohol containing a little sulphuric acid. This solution contains the strychnine as well as various coloring matters. From it the strychnine may be obtained in small white prismatic crystals, slightly soluble in water, giving it a bitter taste even in as dilute a solution as one part in seven hundred thousand. Strychnine is very poisonous, a small amount causing death with violent tetanic convulsions. It is, however, used extensively in very small doses in medicine, being valuable as a heart stimulant, and in cases of paralysis, nervous affections, dyspepsia, etc.

It is a weak base forming salts with acids. The sulphuric acid salt or strychnia sulphate is used generally in place of the free alkaloid.

Strych'nos, a genus of the family *Loganiaceæ,* represented by trees, shrubs, or vines which climb by stiff hooked tendrils, and is mostly tropical. The leaves are opposite, thin or coriaceous, and prominently 3 to 5-nerved. The flowers are small and whitish, collected in dense axillary or terminal cymes, and are salver-shaped, with five valvate lobes. The ovary is usually two-celled and develops into an indehiscent, globose berry with a hard rind and pulpy interior enclosing the seeds. This pulp is sometimes innocuous, and is eaten by birds and men, but the seeds are generally violently poisonous. Those of the Indian *Strychnos potatosum,* when rubbed in a vessel of water, send all the impurities to the bottom, whence the name of clearing-nut tree. Its pulp is edible. While many of the species of *Strychnos* contain the poisonous alkaloid called strychnine, which is used in small quantities as a valuable medicine, most strychnine of commerce is obtained from the button-like, satiny seeds of *S. nux-vomica,* or nux-vomica tree (q.v.), or from those of *S. Ignatii,* the Saint Ignatius bean. Strychnine is also the sole active principle in *S. Tieuté,* from Java, being extracted from the bark by boiling, and employed by the Javanese for poisoning their arrows. *S. toxifera,* a woody climber often three inches thick, with hooked tendrils, and covered with dark-brown hairs, is found in South America, and, with other species, is supposed to be the source of the arrow poison called woorali or *curare.* This substance is black-brown, like an extract, or firmer, brittle and friable; it is used somewhat in medicine as a nervous sedative, and in physiological experiments. The South American Indians put it on arrows, chiefly on those shot from

Digitized by Google

blow-guns, and use it for hunting, since the game is wholesome after being poisoned. Curare acts by paralyzing the terminals of the motor nerves, and causes death instantly when mixed with the blood, by paralyzing the muscles of the chest, and so suffocating the victim. The bark of *S. nux-vomica* was at one time introduced as a substitute for Angostura bark, with such deadly effect that the use of the latter was discontinued for a while. In Brazil, however, the cortex of *S. pseudo-quina* has been used as a febrifuge. *S. colubrina* furnishes the snakewood (q.v.).

Stryker, strī'kėr, **Melancthon Woolsey**, American college president: b. Vernon, N. Y., 7 Jan. 1851. He was graduated from Hamilton College, New York, in 1872 and from Auburn Theological Seminary in 1876. He held pastorates in the Presbyterian Church 1876–83, in the Congregational Church 1883–5, and again in the Presbyterian Church, 1885–92. Since 1892 he has been president of Hamilton College. He is a student of hymnology and has published, among others, the following hymns and poems: 'Song of Miriam' (1888); 'Church Song,' hymnal (1889); 'Lattermath Verse' (1896); 'College Hymnal' (1897).

Stryker, William Scudder, American historian: b. Trenton, N. J., 6 June 1838; d. there 29 Oct. 1900. He was graduated from Princeton in 1858, enlisted in the Union army and served on General Gillmore's staff in South Carolina; was returned north on account of ill-health, resigning his commission in 1866. He was adjutant-general of New Jersey from 1867 until his death. He published a 'Roster of Jerseymen in the Revolutionary War' (1872); a 'Roster of New Jersey Volunteers in the Civil War' (1876); and 'The Battles of Trenton and Princeton' (1898).

Stuart, stū'art, the name of a royal family of Scotland and England, also written Stewart and, less frequently, Steuart. The name is derived from the important office of steward of the royal household of Scotland. The founder of the house seems to have been a Norman baron named Alan, a follower of William the Conqueror, who obtained the lands and castle of Oswestry, in Shropshire. His 2d son, Walter, entered the service of David I. of Scotland, by whom he was appointed dapifer, that is, meat-bearer, or steward of the royal household. The steward obtained from David the lands of Renfrew, Paisley, Pollock, Cathcart, and others in that district; he founded the abbey of Paisley in 1160, and died in 1177. His grandson Walter, held, in addition to the office of steward, that of Justiciary of Scotland. He died in 1246. His eldest son, Alexander, the 4th steward, seized the islands of Bute and Arran, in the right of his wife Jean, heiress of James, lord of Bute. This led to the expedition of Haco of Norway, and the battle of Largs (1263), in which the steward is said to have commanded the right wing of the Scots, greatly contributing to the defeat of the Norwegians. Alexander had two sons, James, the 5th steward, and John, known in history as that Sir John Stewart of Bonkyl, or Bonkill, who was killed at the battle of Falkirk (22 July 1298). The eldest of Sir John's sons, Alexander, was the ancestor of the Stewart earls of Angus; the 2d Alan, of the Stewart earls and dukes of Lennox; the 3d, Walter, of the earls of Galloway; the 4th, of the earls of Athol, Buchan, and Traquair, and the Lords Lorn and Innermeath. James, the elder brother of Sir John, succeeded as 5th steward in 1283. Three years later, on the death of Alexander III., he was chosen one of the regents of the kingdom. He fought bravely under Wallace for some time, but submitted to Edward I. in 1297. In spite of the most solemn oaths which the English king obliged him to take, he died in the service of Bruce in 1309. His son, Walter, the 6th steward, had an important command in the Seztch army at Bannockburn. Some time after, King Robert bestowed the hand of his daughter Marjory upon him, a union which brought the crown of Scotland, and eventually that of Great Britain, into his family. Walter was succeeded by his son, Robert, the 7th steward. During the long and disastrous reign of David II., the steward distinguished himself by his patriotic exertions for the defense of Scotland, defeating the intrigues of that prince and Edward III. to seat Lionel, Duke of Clarence, on the Scottish throne. On the death of David, without issue, the steward peacefully succeeded to the crown as Robert II. in 1371, and died in 1390. From this time to the death of James V. in 1542 the crown of Scotland remained in he direct male line of Stuarts, passing in unbroken succession from father to son. James V. left a daughter Mary who succeeded to the throne. Her son, James VI. of Scotland, succeeded to the English throne on the death of Elizabeth, tracing his claim through his great-grandmother Margaret a daughter of Henry VII. of England. The Stuarts were driven from England in the person of James II. in 1688. See for the history of the royal line, the articles Robert II. and III.; James I., II., III., IV., V.; Mary Stuart; James I. (of England); Charles I. and II.; James II.; William and Mary, and Anne. James II. of England was twice married, first to Anne Hyde, daughter of Lord Clarendon, by whom he had Mary, queen of William III., and Anne, both of whom died leaving no issue. His 2d wife, Mary of Modena, gave birth, on the eve of the revolution, to James Edward Francis, Prince of Wales, commonly called the Old Pretender, or the Chevalier St. George. The legitimacy of this prince was long doubted; a great majority of the nation was convinced that the queen had never given birth to a child; but that there was no imposture is now a matter of historical belief. On the outbreak of the revolution, the queen and her infant son took refuge in France, and on the death of the ex-king, Louis recognized the child as king of England by the title of James III. In 1715 an unsuccessful attempt was made to seat him on the throne of his ancestors by force of arms. James Edward, who had landed in Scotland after his cause had been irretrievably lost, succeeded in making his escape. France, however, no longer offered him an asylum, as the Regent Orleans wished to stand well with the English government, and the Pretender went to Rome, where he lived in obscurity until his death in 1766. In 1720 he married the Princess Maria Clementina Sobieski, granddaughter of John Sobieski, king of Poland, one of the wealthiest heiresses in Europe, by whom he had two sons, Charles Edward Louis Casimir (see Charles Edward Stuart), and Henry Benedict Maria Clement, born at Rome in 1725. In 1745, when the last effort was made for the restoration of his family, Henry Benedict

Digitized by Google

assumed the command of the troops assembled at Dunkirk to aid the operations of his brother in Britain, but the news of the battle of Culloden prevented the embarkation of this armament, and Prince Henry returned to Rome. He took holy orders, and in 1747 was raised by Benedict XIV. to the purple. On the death of his brother in 1788, he assumed the barren title of Henry IX., king of England. When the French conquered Italy he was obliged to flee to Venice, where, stripped of his bishoprics and rich church livings, he lived in great poverty until George III. settled on him a pension of £4,000, which he enjoyed till his death in 1807. Next to the children of James II. in representation of the royal Stuart family, come the descendants of Henrietta Maria, daughter of Charles I., and wife of Philippe, duke of Orleans, brother of Louis XIV. of France. This princess gave birth to two daughters, Mary, who married Charles II. of Spain, but had no issue, and Anna Maria, wife of Victor Amadeus, king of Sardinia.

The present representative of this line is Mary, wife of Prince Louis of Bavaria, eldest son of the regent Luitpold. The present royal family of Great Britain trace their descent through Sophia, electress of Hanover, granddaughter of James I., by her mother Elizabeth, electress palatine, and queen of Bohemia. Edward VII. derives his descent from the electress Sophia through George I., George II., Frederick, Prince of Wales, George III., Edward, Duke of Kent, and Queen Victoria.

Stuart, Alexander Hugh Holmes, American lawyer: b. Staunton, Va., 2 April 1807; d. there 13 Feb. 1891. He was graduated at the University of Virginia in 1828, and began practice in Staunton; was a member of the Virginia legislature in 1836–9, and of Congress in 1841–3. He was secretary of the interior under President Fillmore in 1850–3; held a seat in the Virginia Senate in 1857–61; and in the latter year he was a delegate to the Virginia Convention, where he opposed till the last the secession of the State. At the conclusion of the Civil War, he became a leader in the early reconstruction movement. In 1876–82 and 1884–6 he was rector of the University of Virginia.

Stuart, Arabella, commonly called the Lady Arabella: b. Chatsworth 1575; d. London 27 Sept. 1615. This unhappy and innocent victim of jealousy and state policy was the only child of Charles Stuart, Earl of Lennox, younger brother to Henry Lord Darnley, the husband of Mary, Queen of Scots. She was therefore cousin-german to James I., to whom, previously to his having issue, she was next in the line of succession to the crown of England, being the great-great-granddaughter of Henry VII., whose daughter Margaret, having been first married to James IV. of Scotland, became by a second marriage the mother of Margaret Douglas, mother of Darnley, and Charles Stuart, Earl of Lennox. She received an excellent education. Her proximity to the throne was the source of her misfortunes. Elizabeth, for some time before her decease, held the Lady Arabella under restraint, and refused the request of the king of Scotland to give her in marriage to the Duke of Lennox, his kinsman, with a view to remove her from England. The pope had likewise formed the design of raising her to the English throne, by espousing her to the Duke of Savoy; which project is said to have been listened to by Henry IV. of France, from a wish to prevent the union of England and Scotland. The detection of a plot of some English nobles to set aside James in favor of Arabella Stuart, of which she was altogether innocent, ultimately proved her destruction; for although left at liberty for the present, when it was some time after (in 1610) discovered that she was secretly married to William Seymour, son of Lord Beauchamp and grandson of the Earl of Hertford, both husband and wife were placed in confinement, the husband being committed to the Tower. At the end of a year they both contrived to escape at the same time, but the unhappy lady was retaken. She was then herself committed to the Tower, the remainder of her life was spent in close confinement, which finally deprived her of her reason.

Stuart, Charles Edward Louis Philip Casimir, of Scotland: b. Rome 31 Dec. 1720; d. there 31 Jan. 1788. He was a son of James Francis Edward Stuart, and was known variously as the "Young Pretender," the "Young Chevalier," and "Bonny Prince Charlie." He first saw service at the siege of Gaeta (1734); fought bravely at Dettingen (1743); and next year repaired to France to head Marshal Saxe's projected invasion of England. Sailing from Nantes, he landed with seven followers at Eriska in the Hebrides on 2 Aug. 1745, and on the 19th raised his father's standard at Glenfinnan. The clansmen flocked in; on 17 September Edinburgh surrendered, though the castle still held out; and Charles held court at Holyrood, the palace of his ancestors. There followed the victory over Sir John Cope at Prestonpans, the march upon London with 6,500 men, the fatal turning at Derby (6 December), the victory over Hawley at Falkirk (17 Jan. 1746), the crushing defeat by the Duke of Cumberland at Culloden (16 April), and Charles' five months' hidings and wanderings. The peace of Aix-la-Chapelle (1748) caused his forcible expulsion from France, and thereafter he lived successively at Avignon, Liège, Basel, Florence, and Rome.

Stuart, Elizabeth, daughter of James I. of England. See Elizabeth Stuart.

Stuart, Gilbert, American painter: b. Narragansett, R. I., 3 Dec. 1755; d. Boston 27 July 1828. He was a born portrait painter and took likenesses at 13. In 1775 he paid his second visit to England where Benjamin West recognized his talent, took him into his home and gave him instruction in art. Eventually obtaining much favor and distinction in London he painted portraits of George III., George IV. while prince of Wales, Mrs. Siddons, Sir Joshua Reynolds, Benjamin West, and going to Paris had Louis XVI. as sitter. His great ambition, however, was to practise his art in his own country and he returned to the United States 1792 and opened a studio first in New York; subsequently in Philadelphia, where he painted Washington in 1795. This was the first of a series of portraits of the "Father of his Country" by Stuart. There are still extant six half face portraits from the same sitting, and painted from the right. The famous "Athenæum portrait," now in the Boston Museum, was produced about 1796 and takes the left half face of the sitter. Somewhere about

Digitized by Google

the same time he painted a full length portrait of Washington for the Marquis of Lansdowne. Nearly 40 copies made by him from the original of various sittings are now in existence. In the Metropolitan Museum of Art, New York, Stuart is represented by six pictures, namely: 'Washington' (two portraits); 'John Jay'; 'Captain Henry Rice'; 'Mr. David Sears'; 'Commodore Isaac Hull.' He also painted the first five Presidents of the United States; Edward Everett; Jacob Astor; Judge Story; W. E. Channing; Josiah and Edmund Quincy, and O. H. Perry. The characteristics of Stuart's portraits are fine coloring and life-like expression. Though he has been charged with incorrectness of drawing, he ranks with some of the best portrait painters of the English-American school, his manner being as free, artistic and interesting as that of Gainsborough.

Consult: Mason, 'Life and Works of Gilbert Stuart' (1879).

Stuart, Henry Benedict Maria Clement, Duke of York, cardinal and bishop of Frascati: b. Rome 5 March 1725; d. Paris 1799. He was a son of James Francis Edward Stuart. In 1747 received a cardinal's hat from Benedict XIV. Clement XIII. consecrated him bishop of Corinth, and subsequently appointed him to the suburban see of Frascati. He enjoyed, through the favor of the French court, the revenues of two rich abbeys, as well as a Spanish pension; and the liberal charity with which he dispensed his income endeared him to his flock. On his brother's death in 1788 he caused a medal to be struck, bearing the Latin legend, «Henry IX., king of England, by the grace of God, but not by the will of men.» The French Revolution stripped him of his fortune.

Stuart, James, earl of Murray; regent of Scotland: b. 1533; d. 21 Jan. 1570. He was the natural son of James V. by Margaret, daughter of Lord Erskine. At five years of age his father made him prior of Saint Andrews, and he was long known by that title. He became a warm supporter of the Reformers, and was chosen a member of the council, and one of the lords of the articles. On the return of Mary to Scotland as queen, Murray became her chief adviser, and was created first, Earl of Mar, and then Earl of Murray. He was opposed to the queen's marriage with Darnley, and has been accused of implication in the murder of the latter. He remained out of Scotland for some months in 1567, only returning on the accession of James VI. He saw his sister a captive in Lochleven Castle, and was soon after named regent. Mary having escaped and taken arms, he encountered and defeated her at Langside, in 1568. He was assassinated at Linlithgow.

Stuart, James, English antiquary and architect: b. London 1713; d. 2 Feb. 1788. In his early days he devoted himself to the painting of fans, a profession which gave some room for the cultivation of a genuine artistic talent. In 1742 he went to Rome and engaged in the study of its architectural monuments. When in 1750 he accompanied Nicholas Revett to Greece, he found leisure and opportunity for completing his architectural knowledge. After traveling from point to point of antiquarian interest he finally settled in Athens for nearly three years and amassed a great body of material in the way of sketches and antiquarian notes. He returned to England in 1755 where he found his services much sought after as an architect, but his principal employment was the completion of his *magnum opus*, 'The Antiquities of Athens' in three volumes, only one of which was published before his death.

Stuart, James Ewell Brown, American soldier: b. Patrick County, Va., 6 Feb. 1833; d. Richmond, Va., 12 May 1864. He was descended on his father's side from ancestors distinguished during the colonial and Revolutionary periods, in the War of 1812, and in civil life in Illinois, Missouri, and Virginia. On his mother's side he was a descendant of the distinguished Letcher family of Virginia. After a course at Emory and Henry College, in Virginia, he entered the National Military Academy at West Point, N. Y., and upon his graduation in 1854 was commissioned 3d lieutenant and in October of the same year was promoted to the rank of 2d lieutenant. After serving with the mounted riflemen against the Apaches in Texas he was transferred to the 1st Cavalry, then stationed at Fort Leavenworth. In December 1855 he was promoted 1st lieutenant, about a month after his marriage at Fort Riley to the daughter of Colonel Philip St. George Cooke. He accompanied Colonel Robert E. Lee as aide in the attack upon John Brown and his raiders at Harper's Ferry, where he read to Brown the summons to surrender. In April 1861 he received from the United States government the commission of captain; but he had decided to go with Virginia, and as soon as his resignation was accepted (7 May 1861) tendered his services to his native State, and was three days later commissioned lieutenant-colonel of Virginia infantry. Reporting to «Stonewall» Jackson at Harper's Ferry, he was promoted colonel 16 July 1861, and at the head of 350 cavalrymen began his brilliant career. On outpost duty he was ever vigilant and wary, and of his service at the first battle of Manassas (Bull Run), where he made a dashing charge, General Early wrote that «Stuart did as much toward saving the battle as any subordinate who participated in it.» After the victory had been won he pursued the Federals 12 miles. Subsequently he held the heights in sight of Washington with headquarters on Munson's Hill. In front of this position and at Dranesville he had combats with the Federals. On 24 Sept. 1861 he was commissioned brigadier-general. In the spring of 1862 he covered the retreat from Yorktown and opened the battle at Williamsburg (q.v.). For his daring raid around the army of General McClellan, just before the Seven Days' Battles (q.v.), Stuart won the applause and hearty admiration of both friend and foe, and on 25 July 1862 he was commissioned major-general. He won additional fame by his raid around Pope's army, in which he captured that general's headquarters and a part of his staff at Catlett's Station, by his raid in conjunction with General Trimble upon the Federal depot of supplies at Manassas, his services in screening the movement of Lee's army into Maryland, the brilliant fighting of his troopers at the passes of South Mountain, and by the skill with which he managed his horse-artillery on the Confederate left at Sharpsburg (Antietam), where with these hard fighters he

Digitized by Google

powerfully assisted in the repulse of Sumner's gallant charge.

In October after the battle of Sharpsburg Stuart led his bold horsemen to Chambersburg, Pa., and on his return, thwarting every effort of the Federal cavalry to intercept him, passed between McClellan's army and Washington, and with little loss recrossed the Potomac into Virginia. This expedition caused great demoralization in the Federal cavalry, and by delaying McClellan's advance gave to the Army of Northern Virginia several weeks for rest and preparation against a new invasion.

After the mortal wounding of «Stonewall» Jackson and the disabling of A. P. Hill on 2 May at Chancellorsville, Stuart took command of Jackson's corps and by his audacious attack upon greatly superior numbers completed the work so brilliantly begun by Jackson. When Lee began his movement into Pennsylvania, Stuart, after defeating the Federal cavalry at Fleetwood, or Brandy Station (q.v.), passed again between the Federal army and Washington with orders to meet Early at York. Marching almost without rest for eight days and nights, the last three with almost constant fighting, he joined Lee's army at Gettysburg (q.v.), bringing with him a large train of captured Federal supplies. On the third day of the battle he made a fierce attack upon the cavalry on the Federal right, and at Williamsport, on the retreat, came up in time to drive off the heavy odds of Federals, who were making a desperate fight to capture the Confederate train so bravely defended by General Imboden. On 5 May 1864 he guided the movement of A. P. Hill's corps against Grant's advance, on the 7th gave notice to Lee of Grant's flank march to Spottsylvania Court House and, throwing his cavalry in front of the Federals, delayed them until the Confederate infantry could be thrown across their path. When Sheridan attempted to make a sudden dash into Richmond, Stuart with a part of the cavalry barred his way at Yellow Tavern (q.v.), and saved the Confederate capital. But he received a mortal wound, of which he died next day (12 May 1864) in Richmond. John Esten Cooke has written thus of his last moments: «As his life had been one of earnest devotion to the cause in which he believed, so his last hours were tranquil, his confidence in the mercy of heaven unfailing. When he was asked how he felt, he said, 'Easy but willing to die, if God and my country think I have done my duty.' His last words were: 'I am going fast now; I am resigned. God's will be done.' As he uttered these words he expired.»

In every battle Stuart's black plume had waved in the advance. In every arm of the service he had won the highest honors. Gay and rollicking in camp, merry on the march, often calling upon Sweeny to ride by his side and thrum upon the banjo an accompaniment to his merry songs, he was always fully awake to the demands of duty and equal to any emergency. With all his gayety he was never profane, would not play cards, was one of the purest of men, a devoted husband and father, and a devout Christian. Consult H. B. McClellan, 'The Campaigns of Stuart's Cavalry' (1885).

JOSEPH T. DERRY,
Author of 'History of Georgia.'

Stuart, James Francis Edward, the Pretender, of Scotland: b. Saint James Palace 10 June 1688; d. Rome 1 Jan. 1766. He was a son of James, regent, and Mary of Modena. At six months he was conveyed by his fugitive mother to Saint Germains, where his boyhood was passed, and where, on his father's death in 1701, he was proclaimed his successor. In an attempt, in March 1707, to make a descent upon Scotland, the young «Chevalier de Saint George,» as he was styled by his adherents, showed some gallantry, but was not suffered to land; and after his return he served with the French in the Low Countries, at Malplaquet receiving a sword-thrust in the arm. But in Mar's ill-conducted rebellion (see JACOBITES) he showed himself heavy, spiritless, even tearful, when, too late in the day, he landed at Peterhead (22 Dec. 1715), and sneaked away six weeks afterward from Montrose. France was now closed to him by the treaty of Utrecht, and almost all the rest of his fainéant, dissolute, prayerful life was passed at Rome.

Stuart, John McDonall, Australian explorer: b. Dysart, Fifeshire, Scotland, 7 Sept. 1818; d. London 5 June 1866. He was educated in Edinburgh, where he engaged in business for some time. In 1838 he went to Australia and accompanied Sturt's expedition into the interior, 1844–6. In 1858 he started a series of six expeditions in search of a path across the continent of Australia. The first had no noteworthy result; but on the second, in 1859, he explored much of the country about Lake Torrens. In 1860 he penetrated to the centre of Australia and discovered Mount Stuart; and at last, in 1862, his sixth expedition, succeeded in crossing Australia near the centre of the continent, from south to north and back again. For this achievement Stuart was granted £2,000 and 1,000 square miles of land by the Australian government. He wrote 'Explorations in Australia,' edited and published by W. Hardman (1864).

Stuart, Moses, American biblical scholar and theological teacher: b. Wilton, Conn., 26 March 1780; d. Andover, Mass., 4 Jan. 1852. He was graduated at Yale in 1799; studied law, and was admitted to the bar in 1802; was tutor at Yale for two years; studied theology with President Dwight; in 1806 became minister of the First Church (Congregational) in New Haven; and in 1809 entered upon his life-work as professor of sacred literature in the Andover (Mass.) Theological Seminary, a position which he held until 1848. In the encouragement and direction of biblical study during this period his influence was widely felt, as it also was in the theological discussions of the time, which enlisted many able controversialists of various schools. More than 1,500 ministers were the recipients of his teachings at the seminary, and many pens and pulpits aided in the propagation of his views. Besides text-books and commentaries relating to the biblical writings, he published: 'Elements of Interpretation,' from the Latin of Ernesti (1822); 'Philological View of Modern Doctrines of Geology' (1836); 'Hints on the Prophecies' (1842); 'Critical History and Defense of the Old Testament Canon' (1845); etc.

Stuart, Ruth McEnery, American author: b. Avoyelles, La., 1856. She was educated in

Digitized by Google

New Orleans until 1865; removed to New York in 1885. Her writings include 'A Golden Wedding, and Other Tales'; 'Carlotta's Intended, and Other Stories'; 'The Story of Babette'; 'Solomon Crow's Christmas Pockets'; 'Pockets, and Other Tales'; 'Sonny'; 'The Women's Exchange'; etc.

Stuar'tia, a genus of the tea family, which contains ornamental shrubs and trees, found only in eastern America and eastern Asia. They have simple membranous, deciduous leaves, which turn to brilliant autumnal coloring, and solitary, axillary flowers. These blossoms are large and showy, cup-shaped and like camellias. They have usually five petals and numerous stamens; the fruits are capsules, somewhat woody and contain lenticular seeds, sometimes winged. The two American white-flowered species, from the Southern States are *S. malachodendron,* bearing the largest flowers of the genus, and *S. pentagyna,* flowering in late spring and summer. These are sometimes cultivated, but *S. pseudo-camellia* is more widely known. In its original habitat, mountainous Japan, this species is a tall tree, with smooth, bright-red bark, flaking off in thin, large pieces. It has handsome, elliptical, dark-green leaves, not troubled by insects, and creamy-petaled flowers, with wavy edges, purple filaments, and orange stamens. Like the *S. pentagyna,* it is hardy as far north as Massachusetts.

Stuart's Raid to Chambersburg, Pa. Early in October 1862 the Army of the Potomac, under Gen. McClellan, was encamped on the Maryland side of the Potomac, its infantry from Hagerstown, on the north, to beyond the Monocacy, on the south, with cavalry on both flanks. Advised of some movements in the Union army, Gen. Lee, to ascertain the nature of these movements and to disarrange McClellan's plans for crossing the Potomac, ordered Gen. J. E. B. Stuart, on 8 October, to cross the Potomac, above Williamsport, with cavalry, destroy bridges and railroads, seize horses, do all the damage possible and, if advisable or necessary, recross the Potomac in the vicinity of Leesburg. Stuart selected 1,800 men, 600 each from his three brigades, commanded by Gen. Wade Hampton, and Cols. W. H. F. Lee and W. E. Jones. At daylight of the 10th he crossed the Potomac at McCoy's Ford above Williamsport, with slight opposition, captured the signal station at Fairview, passed Cox's Kanawha division near Clear Spring, taking ten stragglers from it, and marched northward and along the western side of the Cumberland Valley, by way of Mercersburg to Chambersburg, where he arrived at 8 P.M. and passed the night. In the morning of the 11th he destroyed the railroad depots and such military supplies as could be found, including 5,000 new muskets, pistols, and a large amount of army clothing; captured and paroled 280 sick and wounded soldiers in hospital; and seizing over 500 good cavalry horses in the surrounding country, and leaving the town quite early, crossed the South Mountain to Cashtown, where he turned southward, passed to the west of Gettysburg and through Fairfield to Emmittsburg, and thence toward the Potomac. All through Pennsylvania he had gathered in horses, but none were taken from Maryland farms or towns. He passed Emmittsburg after dark, and during the night pushed on, most of the time at a trot, through Woodsborough, Liberty, New Market, and Monrovia, where he cut the Baltimore and Ohio Railroad, and reached Hyattstown early on the 12th, and continued his march to Barnesville, having met no opposition. As soon as it became known that Stuart had crossed the Potomac there was great excitement. Gov. Curtin ordered out troops at Harrisburg; Gen. Wool sent troops from Baltimore to Harrisburg and Chambersburg; Cox's Kanawha division, which was on the way from the Army of the Potomac to Clarksburg, W. Va., was halted at Clear Spring, near Hagerstown; all the fords of the Potomac above and below Harper's Ferry were carefully guarded by infantry; and two brigades of infantry were placed on cars, with steam up, at the railroad crossing of the Monocacy, near Frederick, ready to move at once to the point where Stuart might cross the railroad. Infantry was placed at such points back from the river as it was supposed he would pass on his return. Averell's cavalry was ordered down from near Hancock, and Pleasonton's cavalry, then near Hagerstown, was started in pursuit. McClellan was sure that Stuart's escape was impossible. Stuart heard of the preparations to intercept him, through a captured courier carrying a despatch, and having skilfully avoided Pleasonton's cavalry, pushed on through Barnesville, passed through Stoneman's division of Union troops lying between Poolesville and the mouth of the Monocacy, and sent the head of his column, under Col. Lee, to secure a crossing of the Potomac, at White's Ford, while with the rear-guard he held in check Pleasonton, who was advancing from the Monocacy. Col. Lee found White's Ford guarded by a part of the 99th Pennsylvania infantry, strongly posted on a bluff commanding the ford, and he summoned it to surrender, but met with no response, and at the end of 15 minutes opened with artillery and advanced his skirmishers; upon which the Union infantry retreated and Lee seized the crossing. Stuart, who had been engaging Pleasonton with artillery, followed Lee and in a short time had crossed the river, with over 1,200 horses from the farms of Pennsylvania, and some prisoners, 30 of whom were "public functionaries and prominent citizens," to be held as hostages for citizens of the Confederacy who had been arrested and imprisoned. In the entire expedition Stuart had but one man wounded; two men were captured. From the time of leaving Chambersburg until he reached the Virginia shore at noon of the 12th Stuart had marched more than 80 miles; and during the same period Pleasonton had marched about the same distance. The result of the expedition was very gratifying to Lee, for Stuart brought him valuable information; but it was mortifying to the Union officers to know that Stuart had succeeded in riding for a second time clear around the Army of the Potomac, and it delayed the movement of McClellan, who says that the exhausting service in chasing Stuart "completely broke down nearly all the cavalry horses, and rendered a remount absolutely indispensable before we could advance on the enemy." Consult: 'Official Records,' Vol. XIX.; Allan,

Digitized by Google

'Army of Northern Virginia in 1862'; McClellan, 'Life of Gen. J. E. B. Stuart.'

E. A. CARMAN.

Stuart's Ride Around the Army of the Potomac on the Chickahominy. While Gen. Lee was making arrangements in June 1862 to bring "Stonewall" Jackson from the Shenandoah Valley, to unite with the army at Richmond in a blow upon McClellan, he ordered Gen. J. E. B. Stuart, commanding his cavalry, to make an expedition around the right and to the rear of McClellan's army to ascertain its position and movements. Stuart made a verbal suggestion that it was possible to ride clear around McClellan, and he was permitted to use his discretion in the matter. With portions of the 1st, 4th and 9th Virginia cavalry, under Cols. Fitzhugh Lee and W. H. F. Lee, two squadrons of the Jeff Davis Legion, under Lieut.-Col. W. T. Martin, and a section of artillery under Lieut. Breathed, in all about 1,200 men, Stuart started from near Kelly's Station, on the north bank of the Chickahominy, on the morning of 12 June 1862, and marched northward, west of the Richmond and Fredericksburg Railroad and parallel to it, bivouacking at night near the railroad bridge over the South Anna, 22 miles from Richmond. No fires were permitted at night, nor bugle-call in the morning, when he turned toward Hanover Court House. At the Court House was a detachment of Union cavalry, which Stuart endeavored to surround and capture, but it escaped in the direction of Mechanicsville, and Stuart kept on in the direction of Hawes' Shop and Old Church. Soon after he left the Court House a squadron of the Fifth United States cavalry, under Lieut. Lieb, was encountered, which fell slowly back toward Old Church, from which it had advanced that morning on a reconnoissance. Stuart followed cautiously, took some prisoners, crossed Totopotomoy Creek, and was nearing Old Church when he met Capt. W. B. Royall, who, informed of his approach, had marched from Old Church and joined his squadron to Lieb's, making not to exceed 125 men. Stuart ordered a charge, which was led by Capt. Latané, of the 9th Virginia cavalry. The contest was short and severe, sabres being freely used; Latané was killed and a few men wounded; Royall was wounded by several sabre-cuts; and the Union cavalry was driven back and with difficulty partially rallied by Lieb. Stuart pressed on, drove Lieb, captured and destroyed Royall's camp, and took some prisoners. He had fulfilled his orders by passing entirely around McClellan's right, and had gained sufficient information for Gen. Lee's purposes; but instead of returning, he determined to cut McClellan's communications, go entirely around his army, make him "tremble in his boots," cross the Chickahominy beyond his left at Forge Bridge, and reach Richmond. Two squadrons were sent to the left to Garlick's Landing, on the Pamunkey, and destroyed two loaded transports and some wagons, killing two men and taking some prisoners; while Stuart with the main body marched to Tunstall's Station of the York River Railroad, surprised and captured the guard of 15 or 20 men, overhauled a number of wagons, and fired into a passing railroad train, killing three men and wounding eight. The railroad bridge over Black Creek, near by, was burned, also several wagons and some public stores, when Stuart marched by moonlight to Talleysville, where he halted nearly four hours, and at midnight resumed his march for Forge Bridge, which was reached at daylight of the 15th. The bridge was gone, and the river too high for fording. Some crossed by swimming; but the debris of an old bridge was found; there was a warehouse near by, which was torn down, and Lieut. Burke, with a party, was set to work to build a bridge. Stuart says: "A foot-bridge was soon improvised, and the horses were crossed over as rapidly as possible by swimming. Burke's work progressed like magic, in three hours it was ready to bear artillery and cavalry, and as half the latter had not yet crossed, the bridge enabled the whole to reach the other bank by 6 P. M. Another branch of the Chickahominy still further on was with difficulty forded, and the march was continued without interruption to Richmond." Besides the property destroyed, Stuart reports that he took into Richmond with him 165 prisoners, 260 mules, harness, etc. The only one killed in his command was Capt. Latané, and but few were wounded. The whole affair was very mortifying to McClellan. The orders given for pursuit of Stuart came from four or five general officers, and were so conflicting that movement was paralyzed. The expedition confirmed Gen. Lee in his plan of bringing Jackson down on McClellan's right. See PENINSULAR CAMPAIGN OF 1862; SEVEN DAYS' BATTLES.

E. A. CARMAN.

Stubbes, John, English author: b. about 1541; d. about 1600. He is celebrated as the author of a pamphlet entitled "The Discoverie of a Gaping Gulf, wherein England is like to be swallowed by another French Marriage' (1579), directed against Elizabeth at the time when negotiations for her hand were being made by the Duke of Anjou. For this presumption he, together with his printer, had his right hand cut off.

Stubbes, Philip, English author: b. about 1555; d. London about 1610. He was educated at Cambridge, and in 1581 began to write a series of ballads and other pamphlets directed against the sinful practices of various persons whose conduct did not reach his puritanical standard, and later published a broadside against the English public, entitled 'A View of Vanitie and Alarum to England, or Retrait from Sinne.' This was followed by his more ambitious and better known arraignment of the world in general, which he called 'The Anatomie of Abuses, conteyning a Discoverie or Briefe Summarie of such Notable Vices and Imperfections as now raigne in many Christian Countreyes of the World,' which was published in 1583. His later diatribe 'A Chrystal Glasse for Christian Women' (1591) was still more widely known.

Digitized by Google

Digitized by Google

Digitized by Google

Digitized by Google

Digitized by Google

Digitized by Google

Digitized by Google

Digitized by Google

Digitized by Google

89094370012
B89094370012A

Digitized by Google

Digitized by Google

89094370012

B89094370012A

Digitized by Google

Digitized by Google

89094370012
b89094370012a

Digitized by Google